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THE MOTOR CAR IN INDIA.

THE MOTOR CAR
IN
INDIA.

63910

BY

MAJOR D. WARREN,

The Queens.

ILLUSTRATED.

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CORRIGENDA AND ADDENDA.

Page 2—4th line from bottom of page—for "Authors" read "Author".

,, 6—3rd line from bottom of page—substitute, Rs. 4 to Rs. 5 per 4-gallon drum.

,, 11—First para.—Insurance policies can now be obtained through the Bombay Motor Car Company, Bombay.

,, 51—Since this volume has been placed in the Printers' hands, Messrs. Humber, Limited have decided to build the following models in place of those described on page 51 :—

10-12 H.-P. 4-cylinder Coventry Humber, £280 to £315.

16-20 H.P. 4-cylinder Beeston Humber, £495.

30-40 H.P. 6-cylinder Beeston Humber, £800.

Full particulars can be obtained from The Bombay Cycle and Motor Agency.

INTRODUCTORY.

THE following pages have been written in order to bring within the scope of one book information which the intending purchaser, or owner, of a car in India can, at present, only obtain by consulting many books, and applying to many offices. Time will no doubt remove the difficulties and annoyances which, at present, form serious hindrances to the extensive employment of mechanically propelled vehicles in a country, the natural features of which are so eminently favourable.

At the beginning of the year (1905) the numbers of private and commercial cars registered in the United Kingdom stood at 22,500 and 3,500 respectively. The disproportion between the numbers of cars running for pleasure and business will shortly be sensibly reduced. The manufacturers have "on hand" large orders for the "urgent delivery" of motor omnibuses, char-a-bancs, light delivery vans, and heavy lorries; furnishing unmistakable proof that the commercial man in England has recognised the industrial value of mechanical transport, in spite of—

(1) An elaborate railway system.

(2) The hilly nature of the roads, necessitating proportionally high engine-power and large fuel consumption.

(3) An unsuitable climate.

(4) The use of an imported fuel the money for which finds its way into foreign hands.

In India the reverse holds good—

(1) An inadequate railway system.

(2) Roads stretching for hundreds of miles with no appreciable variation in level —economizing both engine-power and fuel consumption.

(3) A climate with short, fixed, rainy seasons.

(4) The ability to produce an almost unlimited supply of cheap, safe, and clean smelling fuel, *viz.*, alcohol.

This subject of alcohol is one of imperial importance and will be referred to at some length in the following pages. Motors may be roughly classed under the following headings :—

(1) Private, (2) Commercial, (3) Agricultural, (4) Military, and (5) Miscellaneous.

This book is almost entirely devoted to private cars ; other cars, such as Commercial, Agricultural &c., are, however, briefly dealt with.

Attention is called to the Order Form issued with this volume. The pecuniary advantages obtained by its use will be found in Appendix I.

A book of this description will doubtless contain many errors and omissions. The Authors will, therefore, gladly welcome information and corrections (both from private persons and members of the trade) to be noted for future editions.

CHAPTER I.

FINANCIAL.

In order to keep this Chapter within reasonable limits a somewhat broad treatment will be necessary.

I.—Private Cars.

The subject naturally divides itself into

(*a*) Initial cost, and

(*b*) Up-keep and running expenses.

(*a*)—*Initial Cost.*

The prices of all cars referred to in this volume have been tabulated, for easy reference (Appendix II). The list will be found to contain cars which, fully equipped and landed in India, range in price between Rs. 2,250 and Rs. 20,000.

The reader should realize that, although all the cars mentioned in the list have earned the reputation for being among the best procurable at their respective prices, there are, in each class, many other equally well-known names. As a matter of fact, so great is the number of makers of undoubtedly good cars that this, in itself, constitutes a serious difficulty when the would-be buyer has to

make his final selection. This is the case even when there is no uncertainty as to type, power, and price. Every man naturally likes to have a say in the spending of his own money, and if the purchaser of a car confines his attention to new cars, and firms of high reputation, there is no reason why, when once he has grasped a few general rules, he should deny himself the undoubted pleasure of selecting his own car. Strength, speed, power, durability, reliability, accommodation, comfort and elegance all have to be paid for in proportion to the quantity and quality supplied. The man, who cannot afford to get the best of every thing, should select the car which, for the money he is willing to give, combines these qualities, most nearly, in proportion to his requirements.

Another point, that should not be overlooked when considering the initial outlay, is the cost of necessary extras. In advertisements the car is usually shewn with a handsome set of lamps, horn, etc., etc. These however are not, as a rule, included in the price conspicuously printed below the picture. The articles usually included are—

(1) Set of tools.
(2) One or two spare sparking plugs.
(3) Tyre repair outfit and levers.
(4) Pump.
(5) Oil can and petrol squirt can.
(6) Petrol, oil and water fillers.
(7) Assortment of nuts, bolts, washers, etc.

The following are practically necessary and will, of course, add materially to the bill :—

(1) Hood or canopy.
(2) Large waterproof or canvas sheet, capable of entirely covering the car.
(3) Spare accumulator.
(4) Two spare covers and two spare inner tubes.
(5) One spare inlet valve, and one spare exhaust valve, complete.
(6) Three lamps.
(7) Horn or bell.
(8) Canvas bucket.
(9) Voltmeter.
(10) Mats.
(11) Lifting jack.
(12) Spare wiring and rubber connections.

This means, even in the case of a small car, a matter of about Rs. 500. All, or most of these charges may be escaped, and a car can occasionally be bought second-hand for considerably less than its original cost price, fully equipped with all necessaries and even some luxuries, and in practically as good condition as when it left the works. The second-hand car must, however, be approached with caution and looked upon with suspicion. Its outward appearance is no guide to its value. A severe road trial, including a stiff hill or two, followed by an inspection of all bearings, gears, etc., etc., is absolutely necessary; unless you know that the seller has not only knowledge of, and experience in, cars, but also looks upon this

question of selling from an exceptionally high moral standpoint.

If a new car is being purchased from a firm in England, charges for a packing case, dock dues, freight to Bombay, landing and Custom House dues will have to be added. The sum to be paid under these headings will vary according to the size, weight and cost price of the car. The P. & O. Company charge 40*s.* per ton of 40 c.ft. The Customs duty at Bombay is 5 p.c. on the car's cost price. The packing case varies from £4 or £5 up to as much as £25. Indian Railways charge 3 annas per truck per mile at owner's risk and 6 annas per truck per mile at railway risk. If two cars can be got into one truck the charges are 4½ and 9 annas respectively.

(b)—Up-keep and Running Expenses.

The expenses under this heading will vary considerably in different parts of India, until such time as skilled motor mechanics are available in all large cities, and fuel is obtainable everywhere at a reasonable price. No doubt the demand for mechanics will eventually create the supply, but until the present fuel difficulty is overcome little progress will be made as far as automobilism in India is concerned. At the present moment petrol can be obtained in Calcutta and Bombay at the rate of Rs. 4/ or Rs. 5/8 per 4 gallon drum. The same spirit costs Rs. 22 per 8-gallon drum in Lahore. Petrol is classed as a dangerous explosive

in India, and pays railway freight under this heading, *viz.*, 1 pie per maund per mile at owner's risk, and 1½ pie per maund at railway risk. Why petrol, properly packed and conveyed in suitable vans, should be considered more dangerous than kerosene oil, it is difficult to understand. In a properly sealed up tin petrol is perfectly harmless and only becomes explosive when mixed with air and set on fire. Suppose a tin should be damaged in transit and leak, the petrol could not soak into the sheet iron flooring, and woul dquickly evaporate, the fumes being rapidly dispersed by the air currents passing through the van. Kerosene on the other hand would not evaporate harmlessly as above. The recent Long Acre fire furnished a striking proof of the fact that properly stored petrol is not dangerous. The inspection carried out by the Chief Officer of the London Salvage Corps (Colonel Fox) showed that the petrol store alone was intact and uninjured, although the iron lid, fitting close down on to the petrol tins, was covered with burnt wreckage, proving that the heat must have been intense. Petrol is undoubtedly very dangerous under certain circumstances. For instance to bring a naked light near to an open petrol tin, or to open petrol tins in a small godown insufficiently ventilated, would probably, sooner or later, end in a blaze up. But surely the railway authorities can be trusted to take the simple precautions necessary to sufficiently reduce the risk of accident to warrant petrol

being conveyed by train at the same freight rates as kerosene oil.

In the following three estimates of the cost of up-keep of various powered cars, I have taken the price of petrol to be Rs. 1-12 per gallon, and the average monthly mileage at five hundred.

I.

A TWO-SEATED 6 OR 7 H.-P. CAR.

	Per month.
Tyres, petrol, lubricating oil, grease, lamp oil, and accumulators recharging	Rs. 50
One native servant, wages	,, 10
Sundries and repairs	,, 15
Depreciation	,, 25
Total	Rs. 100

II.

A FOUR-SEATED 10 TO 12 H.-P. LIGHT CAR.

	Per month.
Tyres, petrol, etc., as above	Rs. 80
Native servant's wages	,, 10
Sundries and repairs	,, 30
Depreciation	,, 30
Total	Rs. 150

III.

A FOUR-SEATED 16 TO 20 H.-P. CAR.

	Per month.
Tyres, petrol, etc., as above	Rs. 130
Native servant's wages	,, 10
Sundries and repairs	,, 50
Depreciation	,, 60
Total	Rs. 250

In the sundries I have included the cost of at least one motoring paper, such as the *Autocar*. The yearly subscription to this paper is, abroad, 22*s.* 6*d.*, and is money well spent.

If the purchaser includes in his initial outlay a H. F. car vulcanizer, price 2½ guineas, the tyre bills would be considerably reduced.

In many parts of India the recharging of accumulators is both tiresome and expensive. I recently sent two, of 30 amp. hours' capacity each, to Lahore for recharging only. The bill sent in, which did not include rail fare, was Rs. 14, namely Rs. 7 each. Usual charge in England would have been 1*s.* 6*d.* each. The accumulators registered 4-5 on receipt and ran down at once.

From the above estimates the reader will see that it is, if anything, rather less expensive to keep a car in India than in England. Barring serious accidents, this ought to be the case. Tyres if properly looked after should last quite as long as in England, if not longer. The road surfaces are, as a rule, good from the tyre point of view; due partly to the climate and partly to the comparatively small amount of traffic. This last point, combined with the absence of hills, reduces the use of brakes to a minimum.

Petrol is more expensive, but gives a better mileage. A warm dry climate and open roads are responsible for this result. Even during the cold weather I have found no difficulty in starting up, and running my car (a 10-12 Humber with

Longuemare Carburetter) on a mixture of, equal proportions of, petrol and paraffin. The only precaution, I found it necessary to take, was to stretch a piece of fine silk muslin across the induction pipe, at a joint. During a long run, when the engine will not be stopped long enough to become cold, paraffin alone can be poured into the tank. Add petrol before stopping the engine so that the mixture in the feed pipe shall contain a sufficient proportion of it to insure easy restarting. The smell of paraffin is, unfortunately, decidedly objectionable, and the liquid itself is extraordinarily insinuating. Its use cannot, therefore, be recommended, in a pleasure car, except when the petrol supply is running short.

In England, a boy to clean the car cannot be got for much less than 15*s.* a week, whereas a native is well paid at Rs. 9 or Rs. 10 a month, or a syce will do the work in addition to his regular job for an extra Rs. 2 a month.

When touring the motorist is not heavily mulcted in garrage and tips, nor do hotels and dâk bungalows raise their prices for his benefit.

Leaving comparison and returning to the question of tyres. A considerable saving is secured by the use of solid tyres on cars of suitable build. These tyres have been much improved of late, and can, as a rule, be safely used (on the driving wheels at any rate) without materially shortening the life of the car. There will be some loss of speed, and a slight increase in the fuel consumption. The relative advantages of solids and

pneumatics will be discussed in Chapter V.

With regard to insurance I have been endeavouring to obtain quotations; but up to the present without success. The regulations governing the issue of licenses, etc., will be found in Appendix III.

So far the debit side only of the account has been referred to. The items to be entered on the credit side so entirely depend upon circumstances that each individual must be his own accountant. To some people in India "time means money," and to the rest it means something of more or less value. It is, therefore, almost unnecessary to call to anyone's recollection dreary waits for the one possible train in the twenty-four hours, which is seldom punctual and frequently already full to overflowing. Something more than the bare railway fare, or fares, can as a rule be credited to the car.

Here is an imaginary instance, based on fact :—

A and B obtain 3 days' leave of absence to go to L—, distant 89 miles, during "the week." A has a two-seated light car, and can start with his kit and servant as soon after his leave commences as he likes. If he allows 6 hours for the journey he will have at least 1 hour for rest, refreshment and repairs, such as a puncture, etc. He will be able to spend 3 days less 12 hours in L— if he so desires and his car will be available to take him to dinners, dances, etc., etc. Petrol and lubricating oil for the whole time will cost, up-country, about Rs. 25.

B goes by train starting at 9 a.m., the gharries

to and from the station, and rail tickets for self and bearer cost Rs. 10 each way. He has to change trains half way, and finally arrives about 4 p.m., having possibly travelled in the brake van owing to the train being full. This was, however, the best train he could have selected.

While in L— he often finds it impossible to obtain a gharry when he wants one, but nevertheless spends Rs. 7 or Rs. 8 on gharry hire. His return train leaves at 2 p.m., and he has particular reasons for wishing to stay for an hour or two longer. His travelling expenses have come to quite as much as A's, but there can be no question as to which of them has obtained the greater fun for his money.

For purposes of pleasure, as distinct from business, it is difficult to draw a comparison between the horse and the car. The horse can be put to many uses, such as hunting, polo, pigsticking, etc., in which the motor cannot compete. A carriage and pair are cheaper to buy and to keep up, than a moderate sized four-seated car. There is this to be said, however, in favour of the car, it costs nothing when not in use, it is capable of doing the work of several pairs of horses, and at three or four times the speed. Its ailments can be cured, (except in the case of a complete smash up) for the expenditure of a few pounds, often in an hour or two. It can be taken out at a moment's notice, driven fast, left standing in rain and cold, and attended to at any time found most convenient. The horse requires careful and regular feeding, and

constant attention; eats almost as much when standing idle, as when in regular work. Is liable to lengthy spells on the sick list, may die, or have to be shot, at an early age. The fortunate man is he who can keep, and use, both cars and horses.

II.—Commercial Cars.

This chapter would be incomplete without some reference to the commercial value of motor traction.

Where suitable roads exist, the advantages claimed by the advocates for mechanical transport are—

(*a*)—*As compared with animal transport.*

(i) It is cheaper, quicker, and possesses a greater range of action.

(ii) Is ready at a few minutes' notice at any hour of the day or night, and can work for many hours on end without tiring.

(iii) When not working, requires little attention, and costs nothing for up-keep.

(iv) Can make the return journey with a full load, and climb hills, without strain or fatigue.

(v) Takes up less room, than its equivalent in carts and horses, both on the road and in the stable.

(vi) Causes considerably less damage to the road surface, when the wheels are properly constructed.

(b)—As compared with rail transport.

(i) Avoids the delays, expense, and possibility of damage incurred by frequent handling.

(ii) For short distances is considerably cheaper.

(iii) Is more convenient, as hours of despatch have not to be regulated to suit railway time tables, and control does not pass into other hands until the goods are handed over to the purchaser or his agent.

The present state of motor transport in England can be gathered from the following brief references to omnibuses, delivery vans and heavy lorries.

The view taken by the large London Omnibus Companies is clearly shown in a letter sent to the home press a few weeks ago for publication.

EXTRACT.

"The London Omnibus Owners' Federation will be obliged if you will allow them to announce through you the fact that the undermentioned companies and firms already working omnibuses in London have at this moment a very large number of motor omnibuses under construction, and that they will be in actual work during the next few months; and, further, that it is their intention to cover the whole of the roads with motor vehicles at an early date:—The London General Omnibus Co., Ld., the London Road Car Co., Ld., Thomas Tilling, Ld., the Associated Omnibus Co., Ld., Birch Brothers, Ld., P. Hearn, the Atlas and Waterloo Association, the Star Omnibus Co., Ld., the London Omnibus Carriage Co., Ld., C. W. French and Sons, Philips

and Brickland, Camden Town Association, the Victoria Omnibus Association—Hicks, Davis, and Hunt, Solicitors to the London Omnibus Owners' Federation."

Motor omnibus services have been established in many of the large provincial towns. The Railway Companies are running motor omnibuses in connection with their train services. Some of these buses traverse the hilly districts, and during daily runs of over twelve hours keep to their scheduled time with remarkable punctuality. The introduction of motor carriages on branch lines, in England and Scotland, has been followed by an order for similar vehicles for use on the Cape Government Lines. The Indian Railway Companies cannot long shut their eyes to the advantages to be gained by following suit.

The motor omnibus covers on an average 70 to 80 miles a day, running five days in each week.

The following is the approximate cost of running a Chelmsford Omnibus (22,000 miles):—

	£	s.	d.
Interest at 4 % on cost price	36	0	0
Depreciation at 10 %	89	0	0
Fuel (paraffin)	137	0	0
Lubrication	23	0	0
Sundries, repairs, &c.	80	0	0
Wages, one driver	78	0	0
Wages, one conductor	46	0	0
Insurance (fire, vehicle, accident, and third party)	50	0	0
Tyre renewals	95	0	0
	£634	0	0

This bus can hold thirty-four passengers. Taking an average load of 20 passengers at ½*d.* a mile, the yearly profit is £275.

The great demand for delivery vans and light lorries proves that these types have also demonstrated their commercial value. The following estimates give a rough comparison between motor and horse traction :—

10—12 H. P. DELIVERY VAN.

Original cost, £350.

Yearly Up-keep and Working Expenses.

	£	s.	d.
Interest at 4 per cent.	14	0	0
Depreciation at 10 per cent.	35	0	0
Stabling	10	0	0
Drivers' wages	78	0	0
Petrol and lubricating oil	56	0	0
Tyres and repairs	25	0	0
Total £	218	0	0

The above motor van would be capable of doing the work of two or three one-horse vans. Taking the lower estimate :—

Cost of Horses, Vans and Harness ... £150-0-0

Yearly Up-keep and Working Expenses.

	£	s.	d.
Interest at 4 per cent.	6	0	0
Depreciation at 10 per cent.	15	0	0
Stabling	20	0	0
Two car men's wages	124	16	0
Fodder	72	16	0
Repairs, shoeing and Vet's bill	20	0	0
	258	12	0

This shows a saving of over £40 per annum where the car replaces two vans only. If used in place of three vans the saving would exceed £150 per annum.

Lastly the heavy steam and petrol waggons and lorries give infinitely better results than can be obtained by horse drawn vehicles.

These waggons perform the work of five to ten dray horses at a cost of from 2*d.* to 4*d.* per ton mile according as the return journey is made empty or not. They are capable of taking their full load up hills which would be impossible for the horse vehicle to negotiate without additional horses. The railway charges for short distances would vary from 9*d.* to 1*s.* per ton mile. Delivery by motor waggon would, up to distances of 30 or 40 miles, be made within a few hours, by rail a delay of two or three days would often occur. Some months ago, in a small English town, the frequent passing of the same steam waggon attracted my attention. From enquiries made at the time I learnt that it had only been in regular work for a few weeks. I have now received the following particulars from a gentleman in no way connected with either the present owners or the makers of the waggon. He writes :—

"Particulars of the Yorkshire Patent Steam Wagon made by the Yorkshire Patent Steam Wagon Co., Hunslet, Leeds.

The cost of the machine (new) was £550.

For tipping arrangement and sides £30 extra.

The owner has worked it for 9 months at a nominal cost of 9*s.* only for repairs, the running cost for this period came to about £10—this is for lubricating oil, cotton waste—engine stores in fact. The labour required comprises driver and lorryman; if porters are available at each end of journey the lorryman is not required. The weight of the machine unloaded is 2 tons 19 cwts. 2 lbs. (just under the 3-ton limit) and is capable of carrying a total load of 5 tons, fuel not included. Fuel—coke, coal, wood, petroleum oil, or petrol; but with two last a special burner is, of course, required.

Coke, or wood is the best, in owner's opinion. Boiler tubular-pressure 175 lbs. per sq. inch. Steam obtained in 20 minutes. Fuel consumption 2 cwts. coke for 5-ton load per 20 miles; can be run all day if required.

I believe a more powerful machine than this is made by the manufacturers, but I should say the above was big enough for all ordinary purposes.

The owner tells me that in 9 months this waggon has paid for itself. It saves the keep and expenses of nine horses, which he formerly kept, and £9 a week in wages. If any parts should become damaged he can easily have them replaced by the makers. Of course, in India spares would have to be kept.

This is the machine you saw in E——. It did all the Yeomanry Camp transport work last year, and is cutting out all the carters here."

Information from other sources shews that the substitution of lorries and trailers in place of horse transport has resulted in yearly savings varying from £100 to £500 per vehicle.

Turning to India, we find an enormous, poverty-stricken country urgently in need of all round development. Before, however, the fullest advantages can be obtained by the extensive use of motor road transport, it will be necessary—

(i) To expend large sums on roads and bridges.

(ii) To establish factories and workshops where all repairs could be satisfactorily carried out, and where, not only the body work of cars, vans and lorries could be built, but also, in many cases, frames and wheels also.

(iii) To encourage the production of large quantities of cheap "country-made" fuel, *viz.*, alcohol.

(iv) To hold out inducements to inventors to design engines which will give thoroughly satisfactory results when using the above fuel.

Stated briefly, the resulting advantages would include—

(i) The opening up of large tracts of country at present untouched by railways, and the development of those districts through which trains are now running.

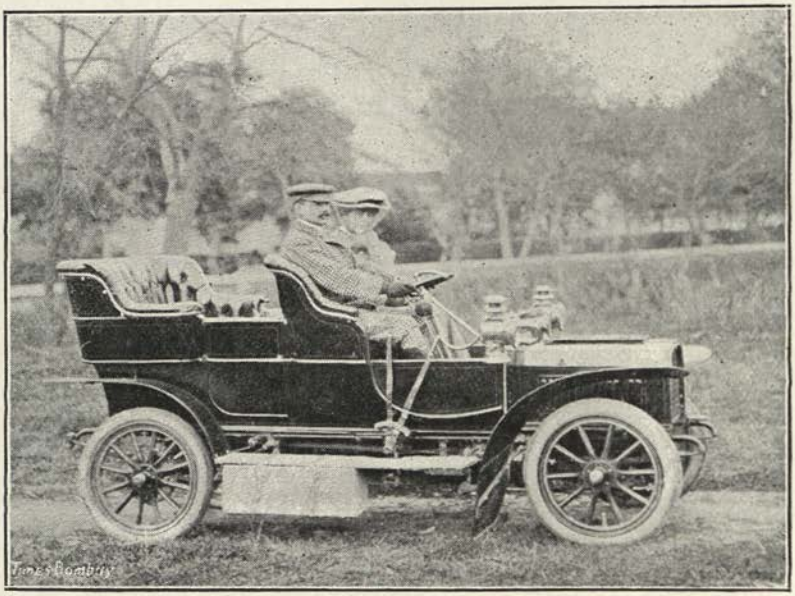
(ii) The employment of large numbers of native mechanics in lucrative employment of a congenial nature.

(iii) The extensive cultivation of grain, potatoes, bananas, and sugary products.

(iv) A large and much needed addition to the revenue derived from a tax of 1 or 2 annas on each gallon of alcohol.

Numberless objections can, no doubt, be advanced, but not one that cannot be either refuted or overcome.

Properly handled, mechanical transport holds out a fair prospect of bringing a greater degree of prosperity to the Indian Empire.



Humber Car.

CHAPTER II.

DETAILED DESCRIPTION OF A TYPICAL PETROL CAR.

THE car chosen to illustrate this chapter is the 10-12 H.-P. Humber Light car. It not only possesses features common to many light cars, but it is also likely to find much favour in India, owing to its neat appearance, comfort, and general excellence, combined with moderate price.

The accompanying photograph gives a good idea of the appearance of one of these cars. It was taken in Sialkot after the car had gone through several months of hard work, including the run from Delhi to Bombay in the 1904-05 trials.

Fig. 1 shews the arrangement of the chassis as seen from above. In front, the reader will notice the radiator, placed in the most favourable position to benefit by the draft created by the car when in motion. Immediately behind the radiator is mounted a fan to draw air through the radiator tubes not only when the car is in motion, but also when it is standing still with the engine running.

Next comes the two-cylinder engine with the carburetter on the right, followed in order by the

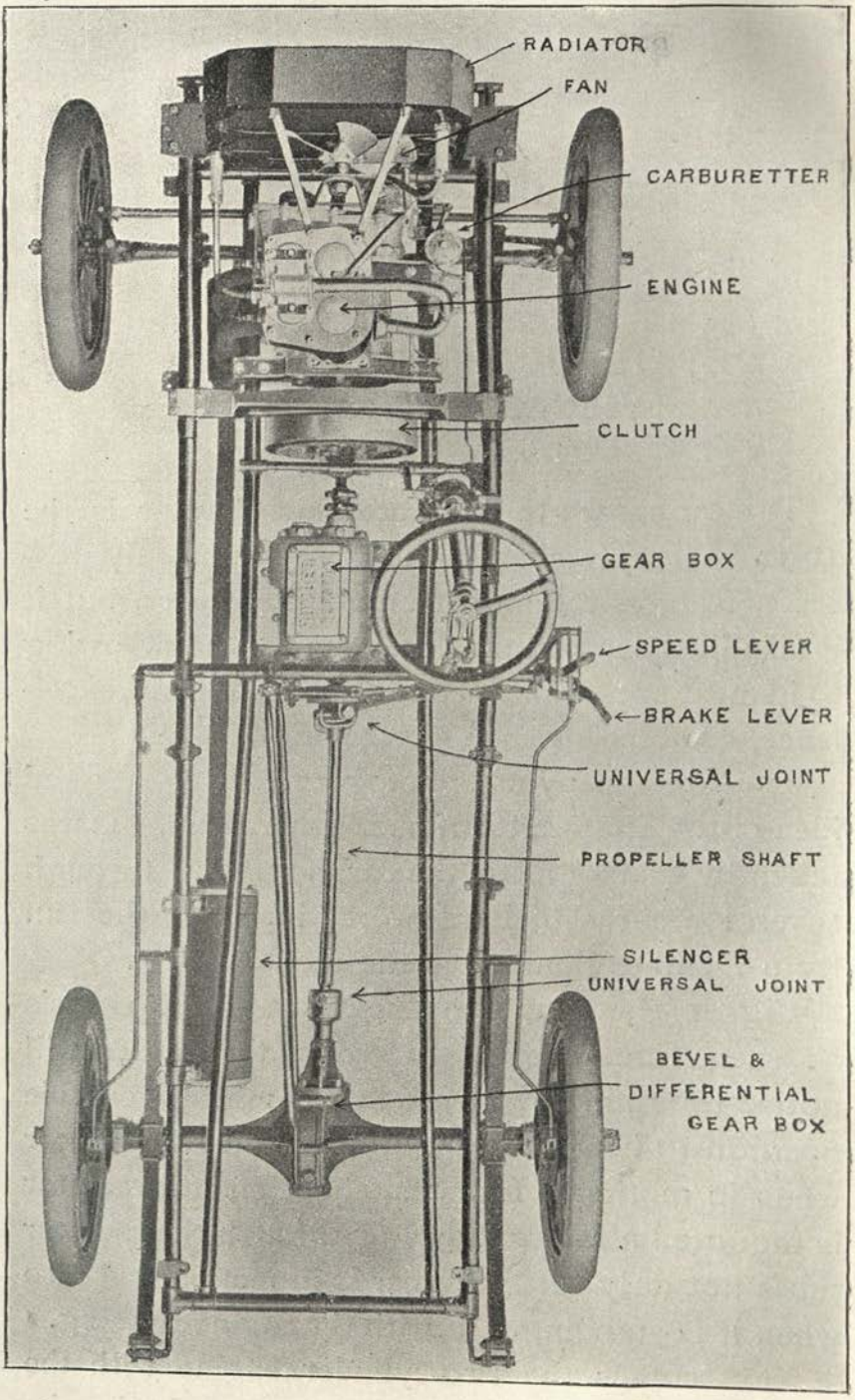


FIG. 1.—Chassis.

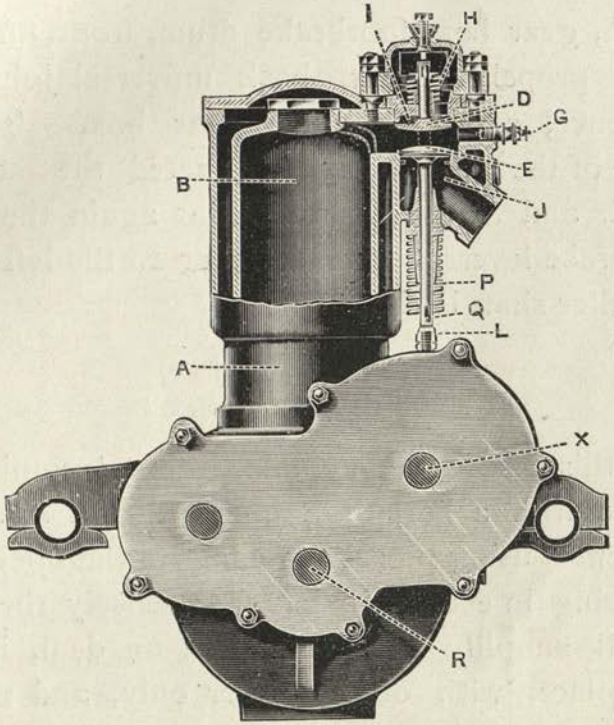


FIG. 2.—Front view of 2-Cylinder Engine.

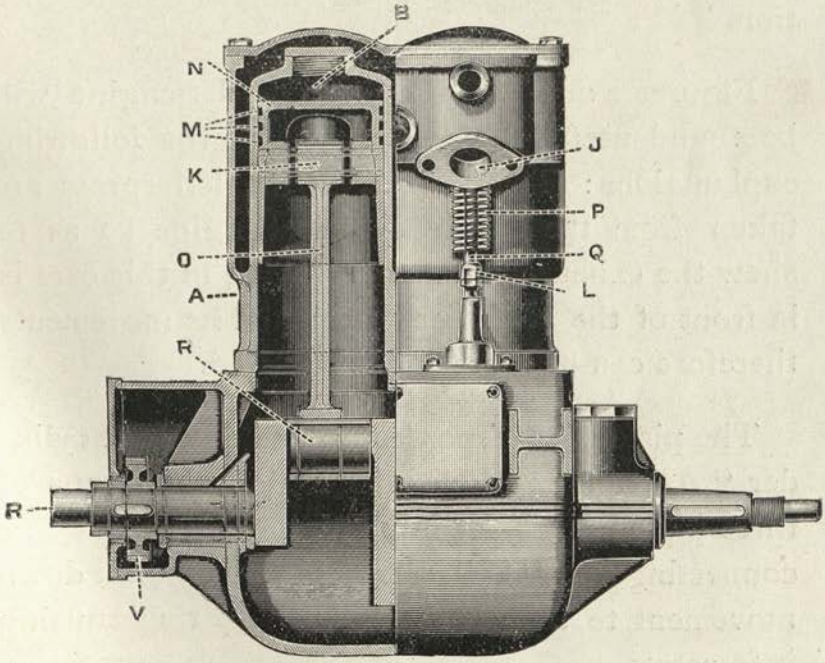


FIG. 3.—Side view of 2-Cylinder Engine, with one cylinder cut through on centre line.

clutch, gear box, footbrake drum, front universal joint, propeller shaft, back universal joint, and the bevel and differential gear box. To the right of the gear box is situated the steering wheel, and to the right of that again the speed and brake levers. The cylinder to the left of the propeller shaft is the silencer.

The Engine.

In this case a two-cylinder internal combustion engine with a bore of 4 inches and a stroke of $4\frac{1}{2}$ inches, using petrol as fuel. As the operations occurring in each cylinder are precisely the same it will simplify the description to deal, in the first place, with one cylinder only, and then to shew how two or more cylinders act in combination.

Figures 2 and 3 of the two-cylinder engine will be found useful in connection with the following explanations: The figures in the letterpress are taken from the single cylinder engine so as to shew the exhaust valve cam, which in this case is in front of the half-time wheel, and its movements therefore can be more easily followed.

The piston "N" passes up and down the cylinder "A," and is rendered gas-tight by means of three piston rings, let into grooves at "M." The connecting rod "O" transfers this up and down movement to the crank shaft "R," thus causing it to rotate.

The complete cycle of operations (which, it will be seen, causes the crank shaft to make two revolutions) is as follows :—

(*a*) Suction stroke, or first downward movement of the piston.

(*b*) Compression stroke, or first upward movement of the piston.

(*c*) Explosion stroke, or second downward movement of the piston.

(*d*) Exhaust stroke, or second upward movement of the piston.

(a)--Suction stroke.

The piston "N" in travelling downwards creates a vacuum in the combustion chamber "B." The force thus exerted overcomes the resistance of the inlet valve spring "H," and opens the inlet valve "D." This allows a mixture of petrol vapour and air to enter the combustion chamber from the carburetter. The exhaust valve spring "P," being much stronger than the inlet valve spring, the exhaust valve "E" remains closed.

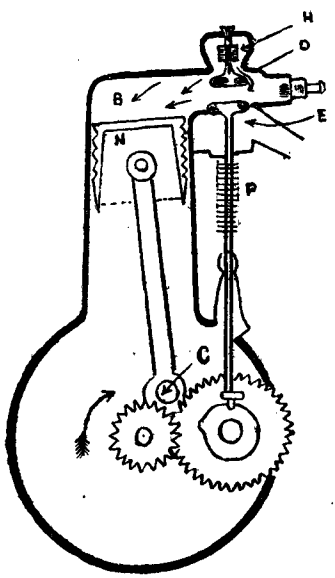


FIG. 4.—Suction Stroke.

(b)—Compression Stroke.

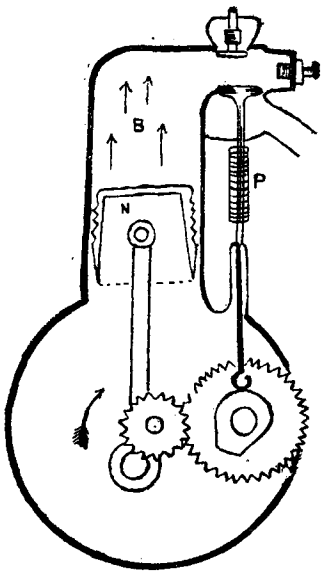


FIG. 5.—Compression Stroke.

On completion of the suction stroke the piston begins to ascend, and the inlet valve spring causes the inlet valve to close. The combustion chamber being now gas-tight the ascending pistion compresses the gas into the upper portion of the cylinder.

(c)—Explosion Stroke.

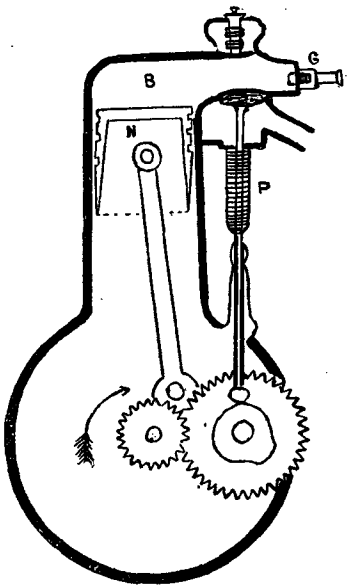


FIG. 6.—Explosion Stroke.

The compressed gas is now exploded by means of an electric spark, produced by the sparking plug "G." The timing of this spark will be explained elsewhere. The explosion drives the piston forcibly downwards, and thus imparts sufficient momentum to the flywheel to enable the engine to complete the cycle of operations intervening between the explosions.

(d)—Exhaust Stroke.

The small spur wheel "V," revolving on the crank shaft "R," causes the larger spur wheel "W" to revolve in the opposite direction. The teeth on "W" are twice as many as the teeth on "V." It therefore requires two revolutions of the crank shaft to cause one complete revolution of "W." The cam "Y," revolving with "W," forces up the exhaust valve "E" by raising the tappet "L." The exploded gases are driven by the ascending piston, through the opening thus made, into the exhaust pipe "J." The opening of the exhaust valve is timed to commence just before the completion of the explosion stroke. The upward pressure of the cam being removed, the powerful exhaust valve spring "P" pulls the exhaust valve firmly down on to its seating again.

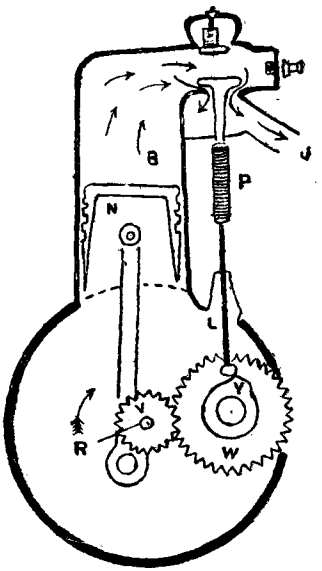


FIG. 7.—Exhaust Stroke.

The reader will now see why the engine must be started by hand. The starting handle will be found at the front of the car, below the water tank. He may also have grasped the advantage of having an engine with more than

one cylinder; if not, the following gives a very rough explanation :—

Single cylinder engine Bang ---- ---- ---- Bang ---- ---- ---- etc.

Two cylinder engine Bang Bang ---- ---- Bang Bang ---- ---- etc., or Bang ---- Bang ---- Bang ---- Bang ---- etc.

Four cylinder engine Bang Bang Bang Bang Bang Bang Bang Bang etc.

"Bang" here represents the impulse giving explosions, during four revolutions of the crank shaft; the "dashes," the intervening operations. Consequently the number of cylinders firing can easily be detected by ear. In the 10-12 H.-P. Humber car the cranks are set at 180°, and the explosions occur consecutively.

THE PETROL SUPPLY.

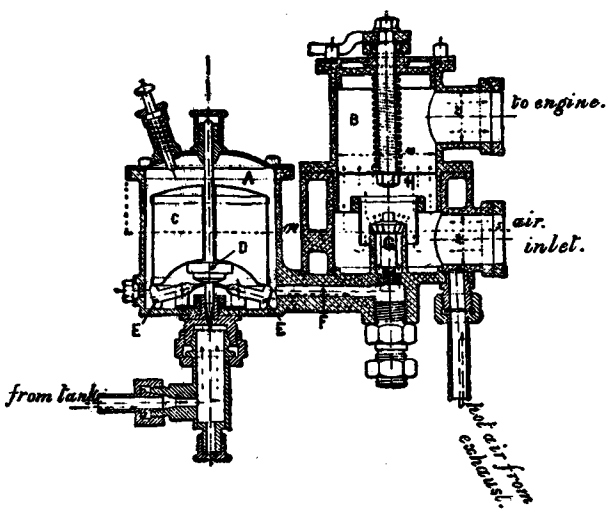


FIG. 8.

We will now return to the suction stroke, and explain how the explosive mixture of petrol vapou

and air is supplied. Petrol is carried in a tank from which it flows to the carburetter either under pressure or by gravity. In the 10-12 H.P. Humber the tank is placed immediately below the two front seats. The neck for filling it being under a trap door, beneath the left hand cushion. A tap below the right bottom corner of the tank enables the supply of petrol to be turned "on" or "off." A pipe running from this tap leads to the float chamber of the carburetter, which is situated on the right hand side of the engine and below the level of the bottom of the tank. This carburetter is a spray or atomising carburetter of the well-known Longuemare type. It consists of two parts, called the float chamber (A) and the spray chamber (B). In the float chamber is a circular metal float (C) through which passes the weighted spindle valve (D). When the float chamber is empty, the float (being heavier than the spindle) raises it by pressing on the rocking levers E E. The petrol flows through the opening thus made, raising the float, and so, by removing the weight on the outer ends of the rocking levers, the needle valve drops down to its seating and prevents the further flow of petrol. The suction of the engine draws the petrol through the pipe (F) into the spray chamber, the float falls, presses on the rocking levers, raises the spindle valve, more petrol flows in, and so the cycle of operations continues as long as the engine exerts the necessary suction.

The petrol, on its passage up the spray chamber,

is sprayed through several nicks round the cone-shaped top (G), it then mixes with air, which enters through the air inlet, and passes as vapour through the perforated plate (H), thence through the induction pipe to the engine. A jacket (I) receives hot air from the exhaust, and assists in the vaporisation of the petrol. The air lever controls the proportion of air to petrol vapour. In this connection must be mentioned the governor throttle, which is fitted to the half-time shaft. When the shaft revolves very rapidly, small weights open outwards, by centrifugal force, and operate a lever, which closes the throttle valve. The engine, as it slows down, allows the weights to resume their normal position. The accelerator pedal, by enabling the driver to hold the governor out of action, permits the engine to run at its maximum speed, according to the position of the ignition lever.

The Ignition.

Our next step is to explain the means by which the gas in the cylinder is fired. The system is one in very general use, namely, Accumulators and Induction Coil. The Accumulators supply the electricity. A switch on the accumulator box completes or breaks the current on its way to the coil. From the coil the electricity flows to a commutator on the half-time shaft. This enables the cylinders to be fired at the proper time. The explanation is briefly as follows. A sparking plug (of which more detailed description is given elsewhere) is fitted into each cylinder and the electric current is made to jump the gap

(thereby causing a spark) between two wires or points at the inner end of the sparking plug. The commutator insures the spark being produced at the right moment. If the current flowed unbroken, a constant stream of sparks would pass between the points of the sparking plugs.

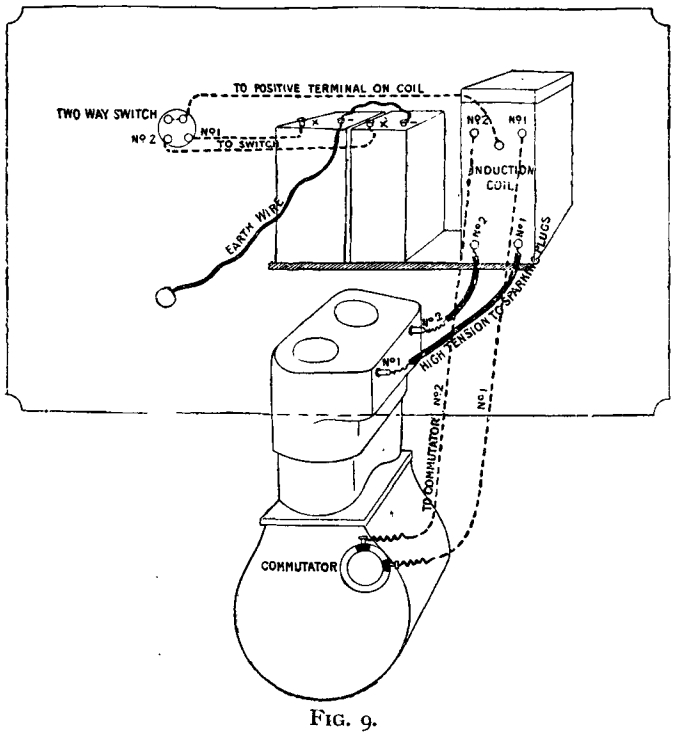


FIG. 9.

To prevent this, and also to insure the spark being produced at the right moment is the business of the commutator. Two pieces of brass "D D," are sunk into a non-conducting fibre ring "A A." The half time shaft "B," causes a metal box to revolve with it.

From one end of this box, projects a metal wiper "C," whichis pressed against the fibre ring by a

spring. The wiper, as it revolves, completes the current, only when in contact with the strips of brass "D D." One segment of brass connects with the 1st cylinder, the other with the 2nd cylinder. The movement of the ignition lever turns the fibre ring round to the left or right, thus advancing or retarding the spark, by causing the wiper to pass over the brass segments earlier or later.

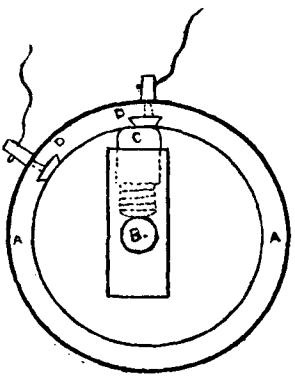


FIG. 10.

Before proceeding further, the reader should carefully study the external views of the engine as shewn in Figs. 11, 12 and 13.

In Fig. 11, the covers closing in the commutator, and timing gear wheels, have been removed, and certain pipes and connections are not shewn such as the petrol feed pipe from tank to float chamber, water pipe from radiator to cylinders, exhaust pipes, wires from coil to commutator and sparking plugs, hand throttle and governor connections, and lubricating oil pipes. All these will, however, be found in Fig. 12 or Fig. 13, so, if the foregoing paragraphs have been thoroughly digested, no difficulty should be experienced in grasping the working of the engine, the fuel supply, and the ignition and water cooling systems. With regard to the last named, the circulation of the

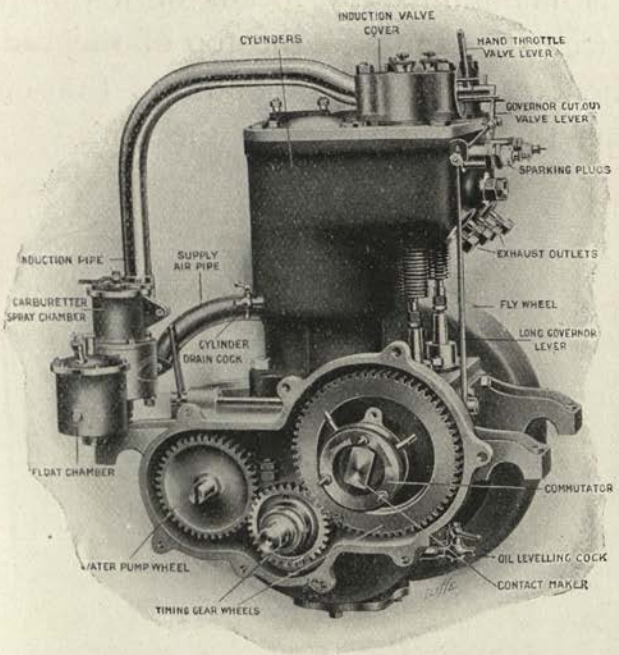

INDUCTION VALVE COVER
CYLINDERS
HAND THROTTLE VALVE LEVER
GOVERNOR CUT-OUT VALVE LEVER
SPARKING PLUGS
EXHAUST OUTLETS
INDUCTION PIPE
SUPPLY AIR PIPE
CARBURETTER SPRAY CHAMBER
FLY WHEEL
LONG GOVERNOR LEVER
CYLINDER DRAIN COCK
FLOAT CHAMBER
COMMUTATOR
OIL LEVELLING COCK
WATER PUMP WHEEL
CONTACT MAKER
TIMING GEAR WHEELS

FIG. 11.

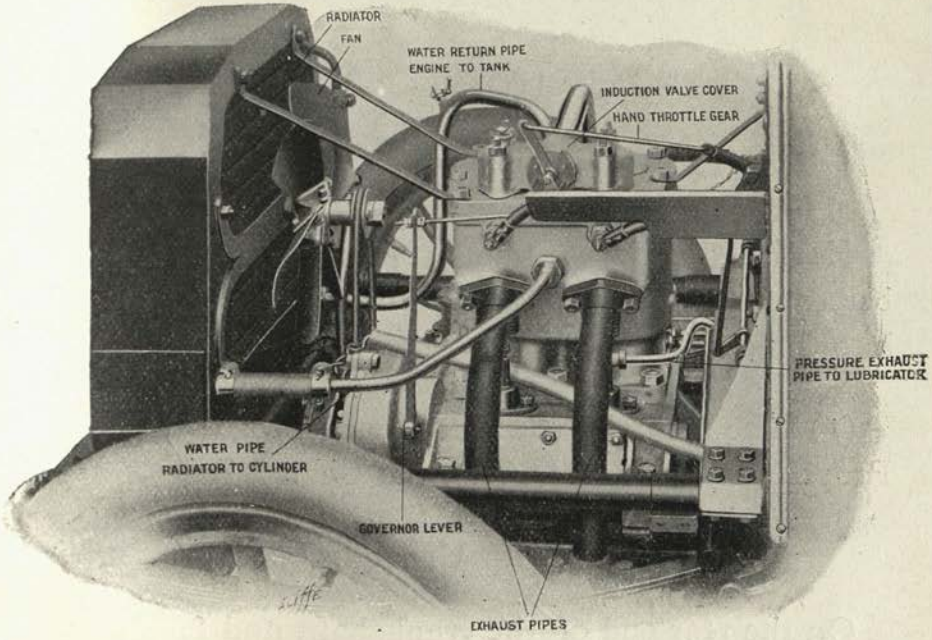

RADIATOR
FAN
WATER RETURN PIPE ENGINE TO TANK
INDUCTION VALVE COVER
HAND THROTTLE GEAR
PRESSURE EXHAUST PIPE TO LUBRICATOR
WATER PIPE RADIATOR TO CYLINDER
GOVERNOR LEVER
EXHAUST PIPES

FIG. 12.

water is maintained by means of a pump, and passes from the tank to the top of the radiator, from the bottom of the radiator to the engine, and from the engine back to the tank.

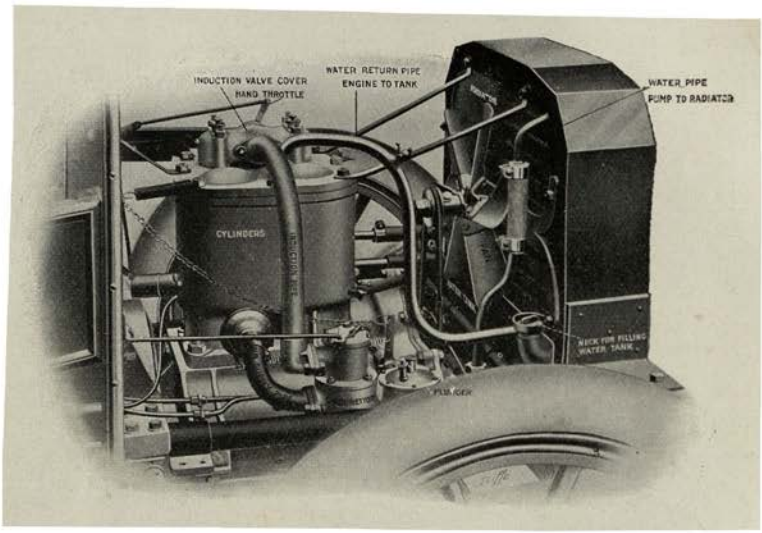


FIG. 13.

GEAR AND TRANSMISSION.

Here again the system adopted on the Humber car is one in very general use. It is divided into three main portions :—

(1) The Clutch, (2) The Gear Box, (3) The Propeller Shaft and Differential Gear.

(1).—THE CLUTCH.

On the rear end of the crankshaft, and fastened rigidly to it, is the fly-wheel. This is hollowed

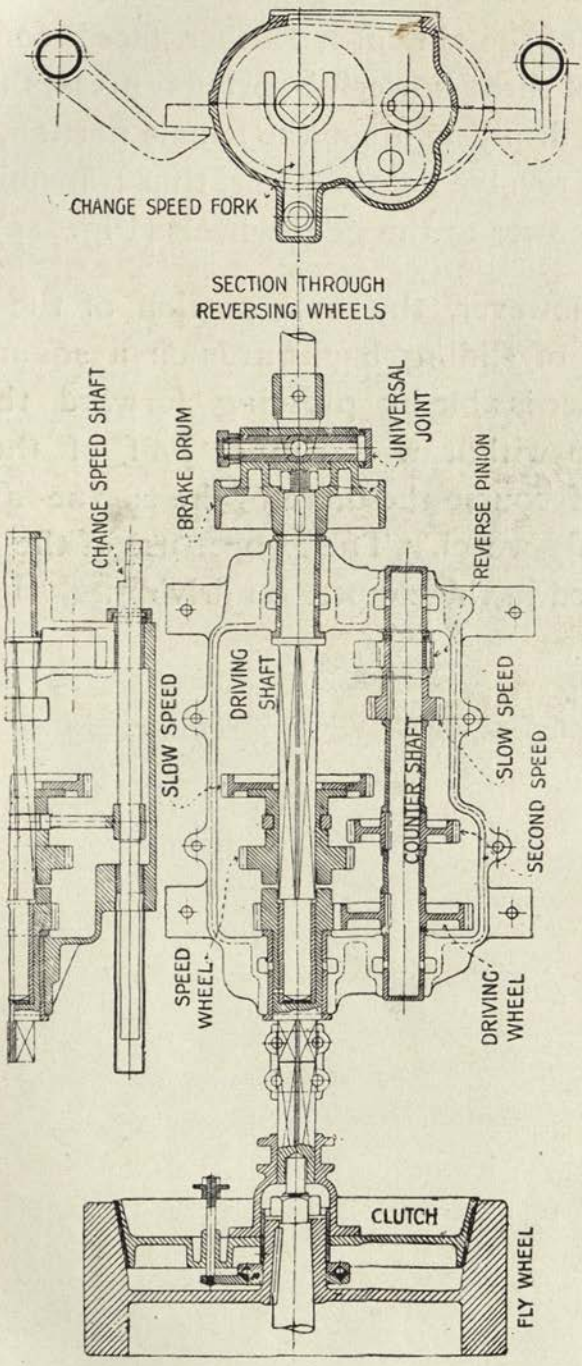

CHANGE SPEED FORK
SECTION THROUGH
REVERSING WHEELS
CHANGE SPEED SHAFT
BRAKE DRUM
UNIVERSAL
JOINT
REVERSE PINION
SLOW SPEED
DRIVING
SHAFT
COUNTER SHAFT
SLOW SPEED
SECOND SPEED
SPEED
WHEEL
DRIVING
WHEEL
CLUTCH
FLY WHEEL

FIG. 14.

out (as shewn in Fig. 14) to take the male portion of the clutch, a leather faced cone. The action of three powerful springs presses the male portion firmly against the female portion, causing them to revolve as one piece, thus transmitting the engine power to the gear wheels (Fig. 15).

As, however, the male portion of the clutch is capable of sliding backwards on a squared shaft, the driver is able by pressing forward the clutch pedal to withdraw the inner half of the clutch, when of course the drive of the engine is confined to the fly-wheel. The proper use of the clutch is explained in the chapter on driving.

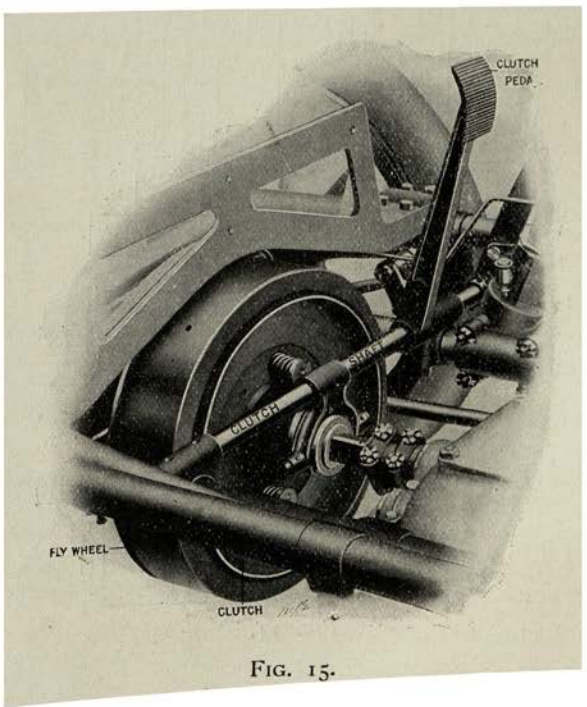


FIG. 15.

(2).—The Gear Box.

The lid of the aluminium gear box is easily removed by unscrewing six nuts, the eight wheels are then all exposed to view (Fig. 16). The first point to grasp is that the shaft between the clutch and the front universal joint consists of two portions, which are able to run at different speeds, the division is inside the front pinion "A" and clearly shewn in Fig. 14. Behind this pinion, the shaft is squared, to admit of it taking the drive from the two sliding pinions "C and D." When the speed lever is in the neutral notch, the pinion "D" is midway between the pinions "F and G," and "C" is between "E and F". The engine being started (with the clutch in) the pinion "A," being always in mesh with "B," causes the countershaft and its pinions to revolve, also the wheel "H." Neither "C nor D" being in mesh, the motion is not communicated to the driving wheels. The driver removes the clutch by means of the clutch pedal, thereby stopping the drive of the engine at the fly-wheel, and then, by moving the speed lever into the low speed notch, causes the striking lever "I" to bring "D and F" into mesh.

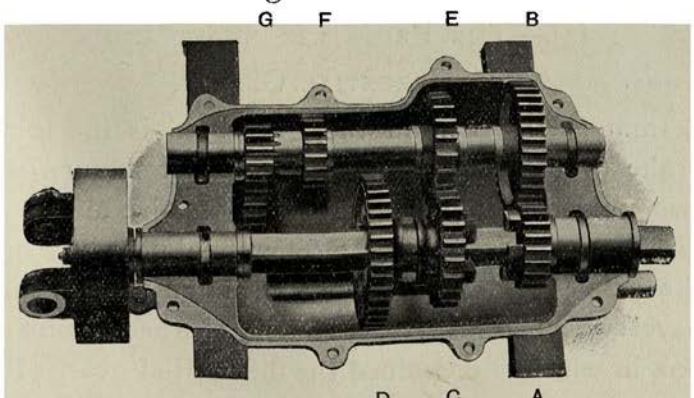


Fig. 16.

Slowly letting in the clutch, the drive of the engine is communicated to the road wheels, through "A B, F and D." In the same way, by pressing the speed lever into the second speed notch, the pinions "C and E" are brought into mesh, and the drive taken through "A, B, E and C." A further forward movement of the speed lever, and the square jaws on "C" are forced between the corresponding jaws on "A," the two portions of the shaft then revolving as one shaft, giving a direct drive from the engine to the driving wheels. In changing gear the clutch must be taken out while moving the speed lever forward.

The reverse is obtained in the following manner: Disengage the clutch, and move the speed lever into the reverse notch. This causes the pinion "D" to mesh with the small wheel "H", which latter is always in mesh with "G." The drive is now through A, B, G and H to D. The latter revolving in the opposite direction to A as the result of the interposition of the fifth wheel H.

(3).—The Propeller Shaft and Differential Gear.

Immediately behind the gear box is the foot brake drum, then comes the propeller shaft (with two universal joints, allowing it to give in every direction), and finally the differential gear box on the axle (Fig. 17). The bevel pinion causes the bevel wheel to revolve. This bevel wheel forms a box in which is contained the differential gear. In

order to enable the two driving wheels to revolve at different rates, as is necessary when travelling round a bend; the rear axle is cut in two, and two bevel pinions are interposed between the bevel wheels which terminate the severed ends of the axle.

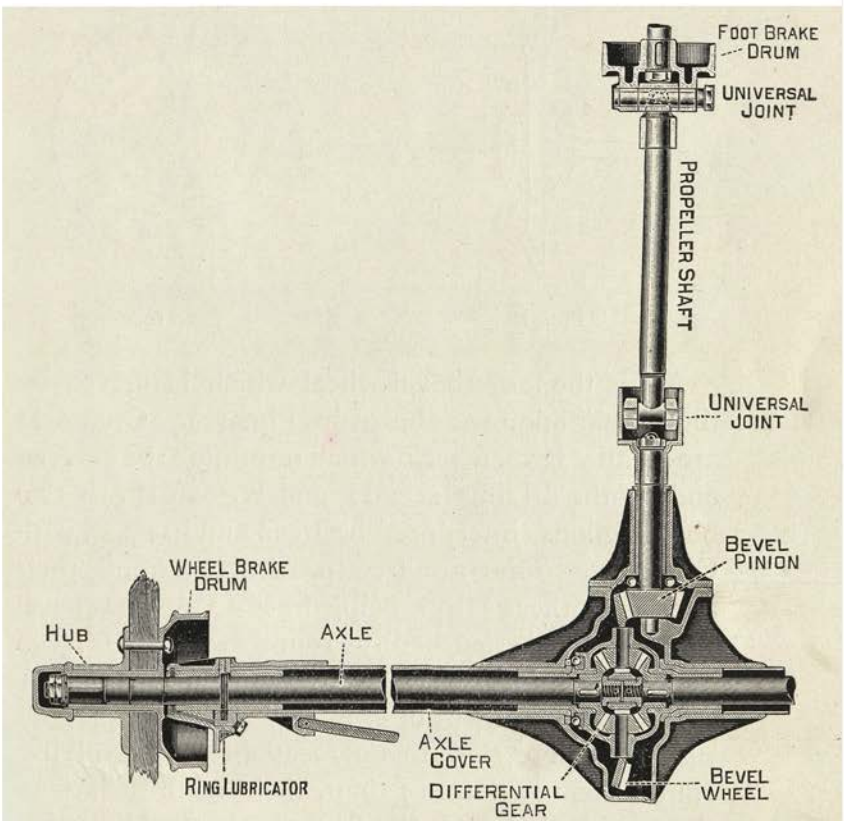


FIG. 17.

Figs. 18 and 19 will enable the principles on which a differential gear acts to be grasped and the more complicated drawings of the various forms of this gear in actual use to be more readily understood.

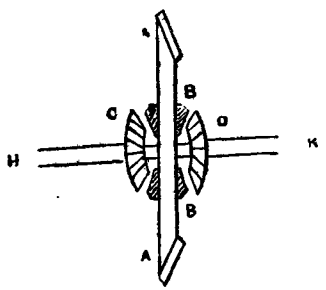


FIG. 18.

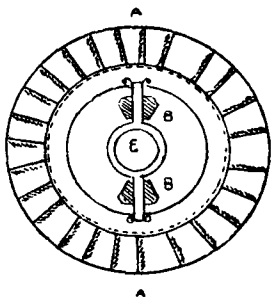


FIG. 19.

AA is the large bevel wheel which is driven by the bevel pinion (as shewn in Fig. 17). C and D are smaller bevel wheels which terminate the severed ends of the driving axle H and K. B B are two bevel pinions, interposed between and in mesh with C and D. They are free to revolve round their axes, but, these latter being fixed to A, the bevel pinions are carried bodily round with the large bevel wheel. E is a short free axle on which A revolves independent of H and K. Now, in the first place, suppose B B to be incapable of revolving round their own axes ; then, their teeth being in mesh with C and D, the five wheels would revolve as one piece. Secondly, suppose A to be fixed and B B free to revolve round their axes. If C be revolved then B B must revolve also, and in so doing cause D to revolve in the opposite direction to C.

Thirdly, suppose D to be fixed and remainder free. If A be now revolved, the pinions B B are made to roll round the fixed bevel D turning on their own axes in so doing. The result is that C revolves at twice the pace that A does. In reality all the wheels are free to revolve. This enables the driving wheels (through the bevels C and D) to revolve at different rates, and even in opposite directions, but at the same time ensures the large bevel wheel A maintaining the mean between them.

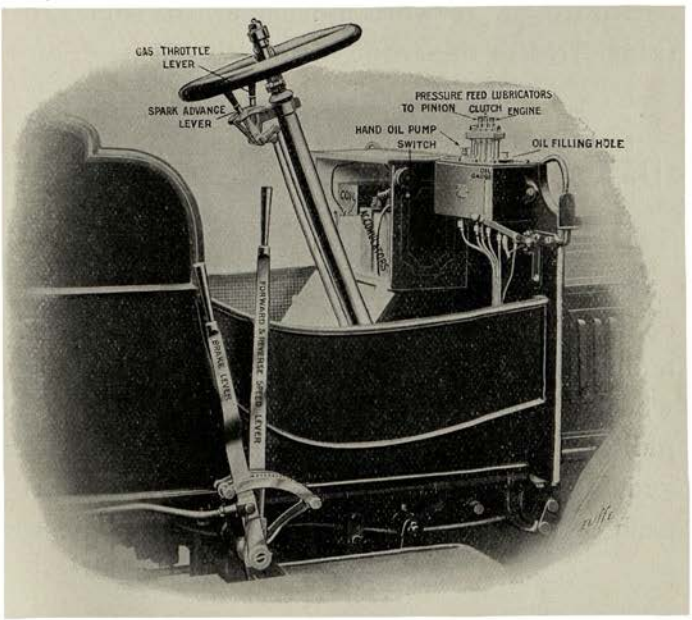


FIG. 20.

CONTROLLING MECHANISM.

The controlling mechanism is placed within convenient reach of the driving seat, as shewn in Fig. 20, and consists of (*a*) The steering wheel, (*b*)

Speed lever, (*c*) Hand brake lever, (*d*) Throttle, ignition, and air levers, (*e*) Foot brake pedal, (*f*) Clutch and accelerator pedals, (*g*) Switch.

It will be sufficient here to describe the steering and brake systems.

STEERING.

The steering wheel is fixed to a shaft which, passing through the flooring of the car, ends in a worm screw. This screw engages with a toothed segment from which projects a stout arm. The backward and forward movement of this arm is transferred to the front wheels through a strong

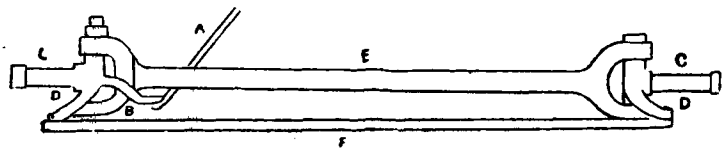


FIG. 21.

connecting rod A (Fig. 21). The main axle E remains fixed, the short arms C and C', carrying the wheels, alone moving in answer to the thrust or pull of the rod "A." The rod F and the arms D and D' insure the wheels remaining parallel to each other at all angles of inclination to the car.

BRAKES.

Two brakes are fitted, namely, the hand brake and the foot brake.

The hand brake (Fig. 22) consists of metal bands lined with leather which, when applied, grip drums bolted to the inside of each driving

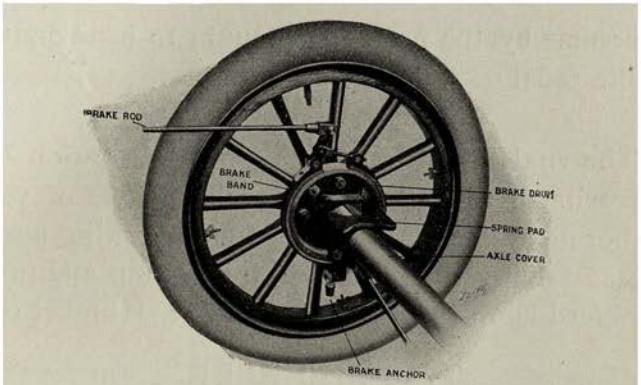


FIG. 22.

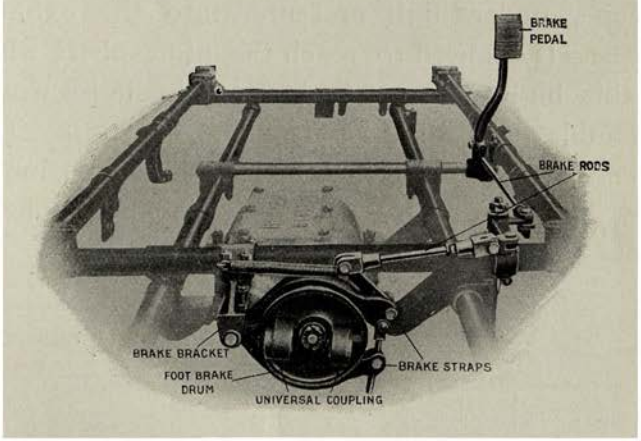


FIG. 23.

wheel. The parts are so arranged that the brake acts with equal power either backwards or forwards. This brake can be left on at any degree of strength required. The foot brake and its connections are so clearly shewn in Fig. 23 that little description is required. The brake drum and straps are both of metal. The spiral spring keeps the metal straps clear of the drum when not

overcome by the pressure brought to bear on the brake pedal.

LUBRICATION.

The vital importance of proper lubrication has necessitated the adoption by all makers of very elaborate systems of oil feeds to all working parts. Fig. 20 shews the oil box with its pump and pressure feed lubricators as fitted on the Humber car.

THE SILENCER.

The gases in the cylinder, after being fired, escape, under high pressure, into the exhaust pipes. If allowed to reach the atmosphere while in this highly compressed state, the noise would resemble that produced by a machine gun. The silencer, by allowing for the gradual expansion of the gas, before it encounters the atmosphere, reduces the noise to within reasonable limits.

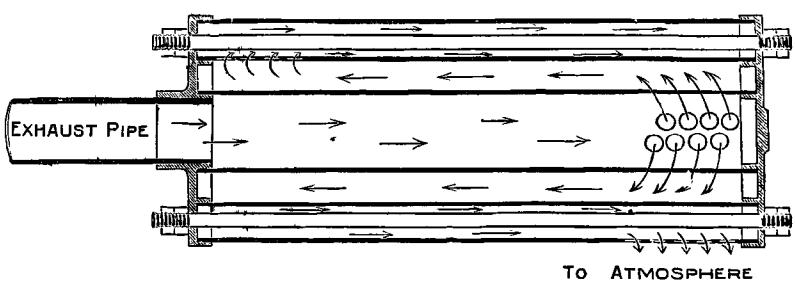
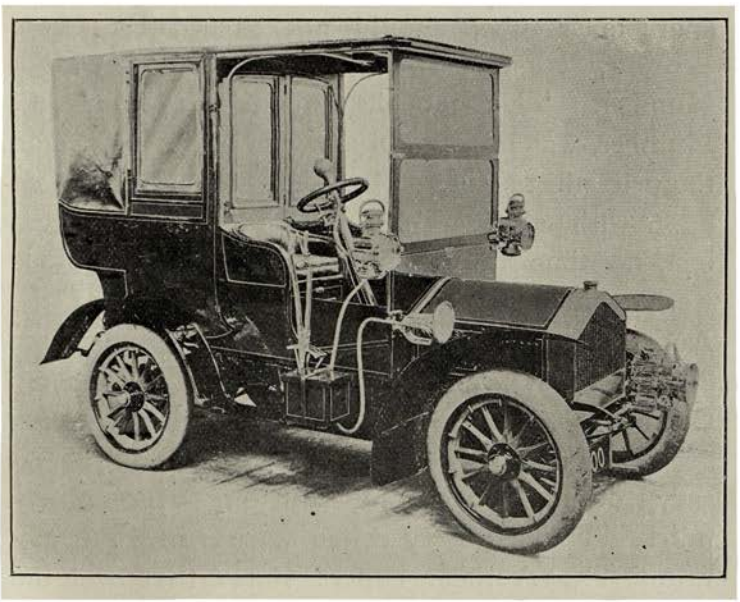


FIG. 24.

Fig. 24 shows the three cylinders, one inside the other, of which the silencer is composed, and also, by arrow heads, the path the gas is forced to take on its way to the atmosphere. Comparative silence, with the lowest expenditure in engine

power, are the results sought for in the construction of a silencer.

Before passing on to the next chapter I will briefly refer to some of the other Humber models. The cheapest car produced by this Company is the single cylinder two-seated 5 H.-P. Coventry Humberette. The price of this car, with a



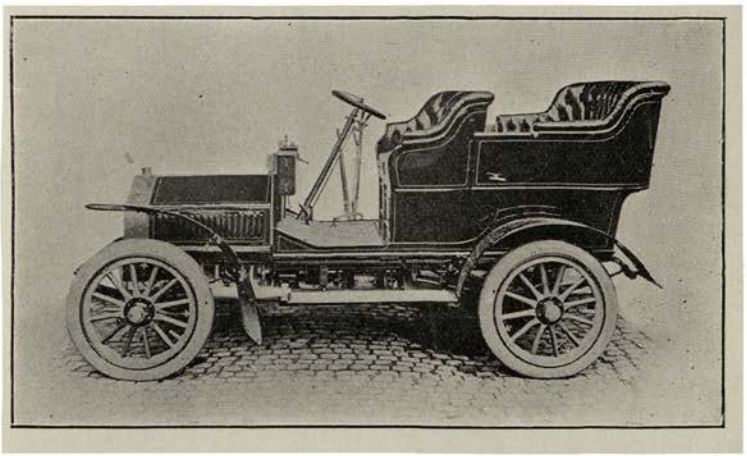
8-10 H.-P. 4-Cylinder Coventry Humber.

considerable number of accessories, is £131-5-0 in England. Landed in India, duty-paid, the price would be just over Rs. 2,250. The running and upkeep expenses would be very low. For station work, on good roads, this little car is capable of giving every satisfaction. The owners of these small cars, however, never seem satisfied

with using them in a legitimate manner, but attempt to get out of them work more suitable for a strongly built touring car. The 6½ H.-P. Royal Humberette, fitted with a hinged glass front, roll-up side curtains, and detachable canopy, is an ideal little two-seated car for town work in India. The price, landed in Bombay, complete with lamps, horn, spare outer cover and spare inner tube, should not exceed Rs. 4,000. We now come to the 8-10 H.-P. four-cylinder Humber. This model, like the 16-20 H.-P. Humber, was introduced a few months ago, and the prices fixed were so low that they were looked upon with considerable suspicion. The makers lost no time in proving that these suspicions were groundless. A member of the staff of the Autocar was driven in a standard three-seated 8-10 H.-P. Coventry Humber from London to Coventry. The car was started on the top speed and no change of gear was found necessary during the whole run of over ninety miles. The last sixty miles were run in heavy rain. The Autocar expert states that even the steepest hills were taken with the greatest ease, the engine never showing the least sign of labouring. Both the new types were entered in the Scottish Reliability Trials and completed the very difficult course with non-stop records. Then followed successes in hill-climbing competitions, more than one first prize falling to these cars. And finally the 8-10 H.-P. demonstrated its speed at the recent Brighton Meeting by defeat-

ing a large field in the scratch race for cars costing between £200 and £350.

The following briefly describes the 8 to 10 Coventry Humber. The frame is of similar tubular construction as in the case of the 10 to 12 two-cylinder car. The four-cylinders have a bore of $3\frac{1}{8}$ inches and a stroke of $3\frac{3}{4}$ inches. The cylinders are cast separately with a single water



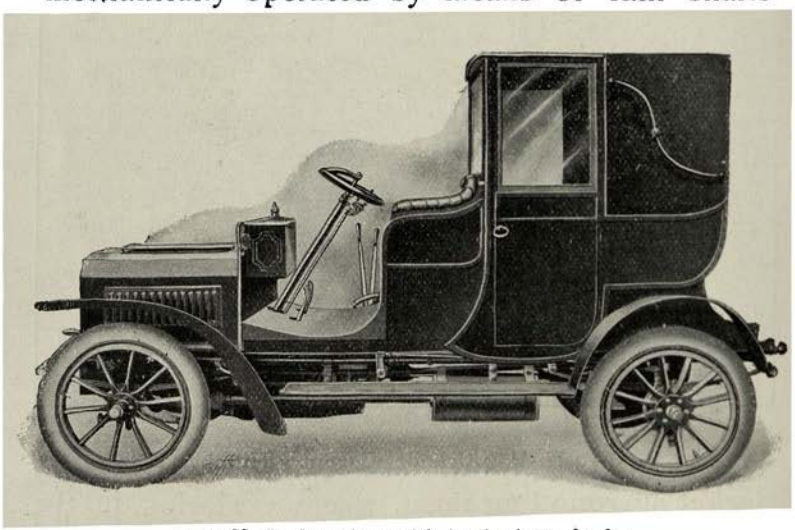
8-10 H.-P. 4-Cylinder Coventry Humber.

jacket surrounding them, a cover closing in the water space. The inlet and exhaust valves are both mechanically operated. The ignition, pump, clutch, change speed gear, back axle, brakes, steering and control mechanism, as also the system of lubrication, are similiar to those already described. The shape of the bonnet and the radiator tubes are distinctive.

The 8-10 Beeston-Humber is a more expensive car and requires a rather more detailed descrip-

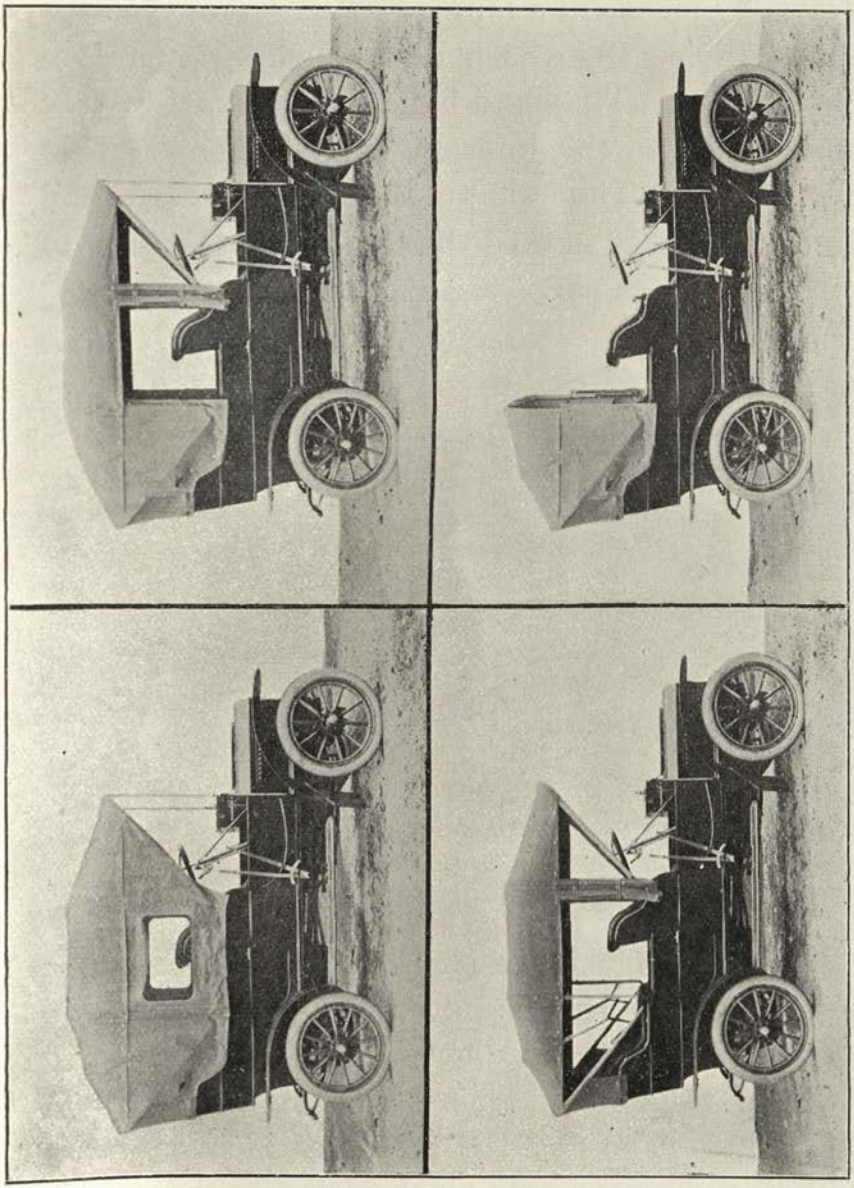
tion. The frame is constructed of channel steel. The side members are 3 inches deep in the centre, and taper to half that depth at the ends.

The cross stays carry the underframe which is made of angle steel. The engine and gear box are attached to the underframe by stout brackets. The inlet valves on the right and the exhaust valves on the left of the engine are all mechanically operated by means of cam shafts



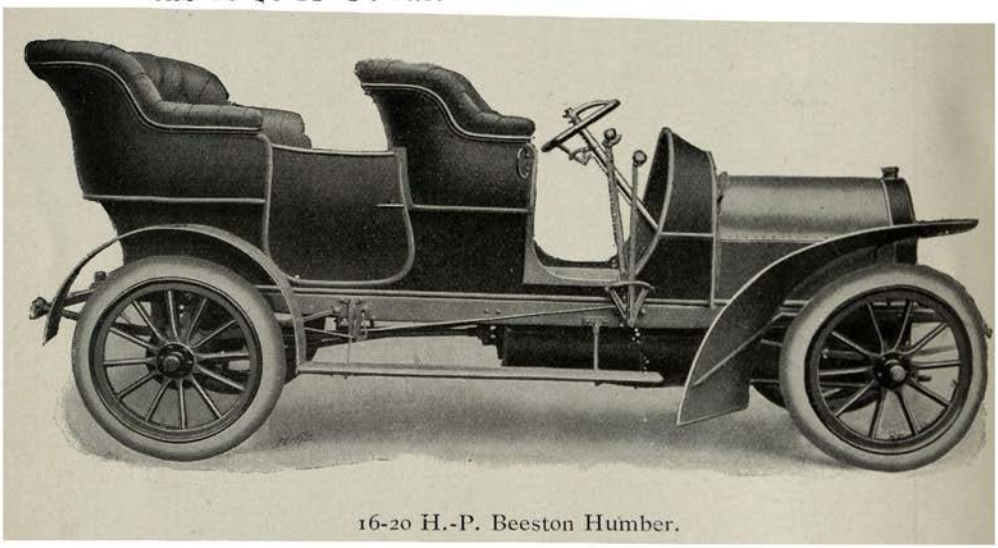
10-12 H.-P. Humber with landaulette body.

and half-time wheels meshing with a pinion secured to the crankshaft. The water pump is driven by the exhaust cam shaft, and the Eisemann high tension magnets by the inlet cam shaft. The magneto-ignition is supplemented by accumulators and coil (as before described), a switch on the dashboard enabling either system to be used at will.



Four views of hood fitted to 10-12 Humber.

The water is cooled by passing through a honey-combed radiator, through which air is drawn by means of a fan. The foot brake, fitted to the driving shaft, is a double acting metal to metal brake. The hand brakes, fitted to the rear wheels, are of the internal expanding metal to metal type. The shape of the dashboard and bonnet can be gathered from the illustration of the 16-20 H.-P. car.



16-20 H.-P. Beeston Humber.

This last named car is provided with a larger and more powerful engine and although built in many respects on the model of the 8-10 Beeston Humber, there are still several points of difference. The chief of these are in connection with the change speed mechanism, the governor, and the lubrication system. The change speed mechanism gives four speeds forward and one reverse, with a direct drive on the top speed.

The main point of difference lies in the fact that a change from any one speed to any other can be made without passing through intermediate speeds. The governor acts on the inlet valve cam shaft, and, by causing it to slide backwards and forwards, the tapering cams vary the lift of the inlet valves from fully open to closed. The consequence being that the supply of gas to the engine varies according to the speed attained by the engine. A foot accelerator is provided to enable the governor to be held out of action if desired. Lubrication is insured by means of a pump driven by the engine. The approximate weight of this car complete is 17 cwt ; the 8-10 H.-P. car weighing about 11 cwts.

Price List of some of the Humber Cars.

							£	s.	d.
5	H.-P.	single	cylinder	2-seated		Coventry Humber	131	5	0
8-10	,,	four	,,	2	,,	,,	236	5	0
,,	,,	,,	,,	3	,,	,,	252	0	0
,,	,,	,,	,,	4	,,	,,	267	15	0
,,	,,	,,	,,	2	,,	Beeston Humber	315	0	0
10-12	,,	two	,,	4	,,	,,	315	0	0
16-20	,,	four	,,	4	,,	,,	472	10	0

Price List of Additional Fittings and Accessories.

	£	s.	d.
Canopy with wind screen in front and curtains all round (to tonneau or side-entrance Cars)	30	0	0
Cape-cart hood with side curtains(to tonneau or side-entrance Cars)	17	17	0
Back seats detachable, and tool-box to fit in place on four-seated Cars	7	7	0
Real leather hood for front seats on all Cars...	15	15	0
Leatherette hood for front seats on all Cars ...	10	10	0
Twill waterproof hood for front seats on all Cars	8	8	0
Glass screen in front on dashboard for all Cars	7	7	0
Rubber mats, each	1	0	0
Set of two side-lamps for Humberette... ...	1	16	0
Ditto, for Humber Light Cars	2	15	0
Tail lamp	0	12	6
Motor horn for Humberette	0	11	6
Ditto, for Humber Light Cars	0	17	6
Voltmeter	0	17	6
Densimeter	0	1	6
Canvas bucket	0	5	6
Lifting-jack for Humberette	1	1	0
,, for Humber Light Cars	1	5	0
Electric flash torch	0	12	6
Inlet valve complete	0	7	6
Extra inlet-valve spring	0	0	6
,, cotter	0	0	3
Exhaust valve complete	0	6	6
Extra exhaust-valve spring	0	0	9
,, cotter	0	0	3
Spare accumulator, 20-amp. hour capacity ...	1	0	0
,, 30-amp. hour capacity	1	10	0
Fibre contact-ring for single-cylinder engine...	0	3	3
Pair of wipers and two screws for ,, ...	0	2	0

PRICE LIST OF ADDITIONAL FITTINGS AND ACCESSORIES—*contd.*

	£	s.	d.
Flexible leather tool-bag	0	7	6
Rubber connections for water joints, each ...	0	1	6
One yard of high and two yards of low tension wire	0	4	0
Sprag	0	12	6

Address—

MESSRS. HUMBER, LTD.,

BEESTON NOTTS—ENGLAND.

Telegrams: HUMBER—BEESTON.

CHAPTER III.

SOME WELL-KNOWN PETROL CARS.

In this chapter all the descriptions have not been written on the same model, as such a method of treatment, though possessing certain advantages, would make exceedingly monotonous reading.

The Napier Cars.

The winning of International Races, and the creation of speed records, both on land and sea, have secured for Napier Motors a world-wide reputation. The Motorist in India is, however, more concerned with the touring car than with the racer. Here again the list of successes gained by standard touring cars, in hill-climbing and reliability contests, is an imposing one. But more convincing still is their behaviour, on extended pleasure tours, in the hands of private owners. Mr. Charles J. Glidden, an American, now touring on his 24-H.P. Napier, has already completed 25,100 miles in 24 different countries, including the Arctic Circle and Fiji.

Mountain climbing, cross country running, and extreme variations of climate appear to have made no impression more serious than the dulling and

scratching of the paint. Roadside repairs, unconnected with tyres, have caused delays totalling in all less than one hour, during this run of over 25,000 miles.

If money is no object you cannot make a mistake if you write to Messrs. S. F. Edge & Co. for a Napier car, stating the work you require it to do, the style and colour of carriage body, and the price you are prepared to go to; leaving the selection of the engine and the working out of details to the firm. The initial cost will be considerable, but full value will be obtained in durability, speed, comfort, ease of control, silence, reliability, and hill-climbing power.

The following brief account of the main features of the "Napier" is extracted from a letter, written by Mr. S. F. Edge, in which he says nothing in favour of the car that has not been amply proved:—

"Briefly summarised the following is a general "description of the Napier car. First there is, in "front, the engine with four or six cylinders, "which is covered with an aluminium bonnet, then "comes the friction clutch which is metal to metal "on all the more powerful types, by which the "power of the engine can be transmitted at will to "the gear. The oil-tight gear-box, in which all "the change speed gears and the differential run, "is made of aluminium. All the bearings for this "part of the car are lubricated directly and in-"dependently, as well as from oil splash in the "gear-box. On each end of the differential shaft

"are fitted chain wheels and chain for transmitting "the power from the gear to the road wheels. In "the chainless types when the top speed is in, "there is absolutely a direct drive by propeller "shaft on to the main driving bevel. The result "of this convenient distribution of the parts, places "a nearly equal weight on each wheel. These "portions of the car are bolted to the frame, which "is, in turn, supported on very long bluish steel "springs attached to the wheel axles in order to "prevent the vibration reaching either the machi- "nery or the passengers.

"One particular point about the Napier car, "that has always been striven after, has been to "ensure that the car will run many thousands of "miles without the need of a repair shop, and it "has been owing in some measure to this reputa- "tion that its success has been so rapid. For "example, in regard to that most expensive part, "the gear and gear-box, it has been and is still "the usual practice, in most cars, for the sake "of cheapness to fit plain phosphor-bronze "bearings and thrust blocks. While these are "fairly satisfactory for some little time, they "require renewing at rather frequent intervals; "and though these parts are not costly in them- "selves to refit, yet the renewal involves a "good deal of time and work being spent in suffici- "ently dismantling the car to reach the parts, and "in subsequently re-erecting the machinery. In "the Napier, these plain bearings, wherever heavy "stresses come, have ball-bearing thrust blocks,

"and roller bearings fitted to the ordinary shafts, "with the result that, if necessary, a guarantee of "a life of 100,000 miles can be given for the gear "wheels and bearings. My experience is that, "though the original fitting of these bearings is "costly, they pay for the initial outlay over and "over again by abolishing the necessity for renew-"als and replacements.

"Another point of Napier origin now exten-"sively copied is a very solid and lasting engine, "so far as crank-shaft, piston rods, and brasses "are concerned; yet extraordinarily light in a com-"plete form owing to the use of aluminium for the "whole body of the engine. This system of con-"struction, involving the use of a light motor jack-"et of a different metal to that of the cylinder, is "the recognised practice with high-class engines "on motor cars where reduction of weight is an "important factor.

"*Inlet Valves.*—A further originality in Napier "engines is the inlet valve, each valve really "consists of a cluster of three or four small valves; "the reason for this being that the combined "circumferential lengths of three small circles in "a given space are greater than the circumference "of one large circle occupying such space. As "the quantity of gas passing at each lift of the "valve to the same height depends on the length "of the edge of the valve, the result of this "arrangement is that a greater volume of gas is "sucked in at each piston stroke, and greater "power in the engine thereby results. There is

"even now an improvement on this system of inlet "valve, *viz.*, the Napier Annular Inlet Valve, in "which the valve has three rings or seatings, by "which arrangement the gas has access through "a much greater circumferential opening than is "given by the ordinary valve seating with the "same diameter. The superiority of this type of "valve is obvious, as it tends to give either very "quiet or very quick running with an efficient "engine. All these points, although peculiarly "technical, are interesting, as they are the result "of experience gained by hard driving on the road "by Mr. M. S. Napier and many users of Napier "cars.

"*Governor.*—The Napier is absolutely automatic, "and acts upon the intake of the mixture in such "a way as to keep the engine running as slowly "as possible when doing no work. If work is "being done, the governor cuts off the gas, as soon "as sufficient power is developed, to do the work "that is required, even if this is only half the "possible power of the engine. The principle of "this is economical, highly efficient, and yet of "great simplicity.

"*Ignition.*—The Napier ignition is invariably "electrical, and Mr. Napier was the first great "constructor to have the courage to refuse to fit "the dangerous tube ignition now seldom em- "ployed, except in the case of old type or obsolete "engines. His position in this respect is a credit "to the English industry. In using electric igni- "tion the only source of trouble is failure to keep

"the accumulator fully charged, but one should "no more call this a fault in ignition than omit- "ting to fill the petrol tank should be brought "forward as showing a faulty engine. The latest "type of electric ignition, as fitted to all types of "Napier carriages, is a High Tension Synchro- "nised Ignition, by means of which only one coil "and one trembler be used, so that regular firing "in all cylinders is absolutely insured.

"*Water Circulating Pump.*—This part of the car "appears to me now to be almost perfect in use, "and as there is a gauge to show if the pump is "working, fitted to the dashboard, there is no "excuse for damage to the engine by pump "failure. I find from my diary that personally I "have driven my last 11,000 miles without a "single stoppage attributable to the pump, and "with only three tyre punctures.

"*Lubricators.*—These are automatic and abso- "lutely act up to their name, and there is an "arrangement by which the lubricator can be "refilled from an auxiliary tank.

"*Control.*—I may now deal with the control of "a Napier car from a driver's point of view, as "one occupying the driver's seat. You have before "you the steering, arranged in such a position "as to give the maximum power with comfort for "driving over the longest distances. The steering "wheel is connected to and actuates the front "road wheels; all the various levers and parts "necessary being adjusted to take wear, including "steering, every part of which is adjustable. This

"point does not appeal to the beginner, but is "really of the greatest importance, as for perfect "control, the smallest turn of the steering wheel "should actuate the road wheels. Indeed, unless "there is provision to take up the wear which "must inevitably take place, there would be play "and rattle in these important parts with a result-"ing discomfort in use, to say nothing of the "danger. It is the carrying out of important "details of this sort which cost money that helps "to account for the great difference of price "between motors with a reputation to keep up "and those made merely to sell. On either side "of the steering shaft that carries the steering, "there are two pedals just rising above the floor "boards in the most convenient position for control "by the driver's foot; the left one, when depress-"ed, actuating the friction cone by which the "power of the engine can be conveyed to the "driving gear. The act of pressing it down cuts "the power of the engine off the gear. In allow-"ing it to resume its normal position which it is "forced into by a powerful spring, the engine is "allowed to drive the car by more or less pressure, "so that the speed of the car can, to a certain "extent, be controlled. On the right of the steer-"ing wheel shaft is another similar pedal; but "this, when pressed down, actuates a brake on the "differential shaft, and if heavy pressure is applied "by the foot, the driving wheels can be absolutely "locked. To the right of this pedal is another "small one called the accelerator pedal, and by

"gentle pressure on this the speed of the engine "can be increased from 250 revolutions per minute "to over 1,000, and thus the speed of the carriage "increases nearly four-fold on any one of the gears, "the function of which I will shortly make clear. "The duties of the accelerator, as ordinarily fitted, "are often not understood, and it is frequently mis- "used. On the Napier, the engine and governor "are so arranged that if no pressure is put upon "the accelerator, the engine automatically runs at "its very slowest, quietest, and most economical "speed, does the best possible work that it can do, "and yet keeps running. When the gear is con- "nected, the accelerator should only be used to "keep the engine up to the power required from "it, but should never be used to make the engine "run so fast as to make a knocking noise. The "Napier engine is so designed that, when doing "its best, nothing more than a pleasant hum "should be audible.

"In front of the driver on the dashboard is "arranged the sparking coil, contact breaker, "paraffin pump for cleaning the inside of the cylin- "der, and the automatic lubricator which starts "when the engine starts, varies the quantities of "oil given to engine with its speed, and when the "engine comes to rest the lubricator stops as well. "On the right-hand side of the driver are arrang- "ed two levers : the outside one being an extra "very powerful brake acting on both back wheels, "The inside lever controls the three or four for- "ward speeds and the reverse. The speeds on a

"standard four-cylinder car are generally arranged "as follows, provided the engine is running at 900 "revolutions per minute:—

"First speed ...	...	...	12 miles per hour.
"Second speed	...	...	22 ,, ,, ,,
"Third speed ...	...	...	32 ,, ,, ,,
"Fourth speed	...	...	44 ,, ,, ,,

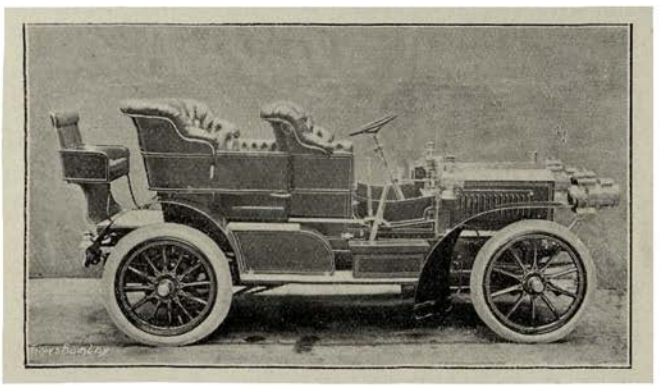
"and a reverse is fitted giving up to twelve miles "an hour.

"The speeds can all be somewhat increased by "the use of the accelerator at will or a hand throt- "tle usually fitted on top of the steering wheel, "so the speed can be reduced to exactly that speed "at which it is desired to travel, in fact it can be "said that the various types of Napier carriages "between them offer every opportunity in the way "of speeds for travelling at one mile or less per "hour up to the racing rate of 110 miles per hour.

Keeping in Order.—Dealing with the use and "keeping in order of a Napier car, one of the "chief points to be borne in mind is always to "have at least two gallons of lubricating oil in the "gear box ; if more is put in it causes no harm, it "merely runs on the road. In the crank chamber "there should always be half a gallon of oil less "half a pint ; if the overflow pipe is opened, any "quantity in excess of this will flow away. All "wheel caps should be kept filled with an equal "mixture of grease and oil, and all grease caps "must be kept filled and screwed down. If these "points are attended to, the motor and car will "run many thousands of miles without any repair "or renovation being required. A great point to

"be remembered is that the car and motor are "much improved by being taken to pieces after "a year's running of 10,000 to 20,000 miles. "After that mileage a good overhauling at the "works is desirable, but otherwise if a car lubri- "cates properly and regularly, nothing but chains "and tyres require the workman's attention.

"Re *Spare Parts*.—I always carry a spare inlet "valve complete, also an exhaust valve and spare "sparking plugs : with these I feel safe to go on



24 H.-P. Napier.

This form of body solves the difficulty with regard to the disposal of the mechanic or native servant.

"almost any journey. Of course they seldom "fail, but if no spare parts are carried and a failure "does occur, then one is sorry not to have them. "In conclusion, remember that the Napier is "London-made, and the works are open to the "fullest inspection to enable anyone to see the "wonderful care and skill employed in their con- "struction. It is generally a great surprise to

"engineers in other branches of mechanical indus-
"try to see the beautiful work put into the best
"automobiles."

The following prices include the chassis complete with pneumatic tyres, but without carriage bodies :—

15 h.p. 4 cylinder chain drive... ...	£750
15 h.p. ,, ,, ,, ...	£800
20 ,, ,, optional ,, ...	£875
24 ,, ,, chain ,, ...	£900
30 h.p. 6 cylinder ,, ,, ...	£1,150
40 ,, 4 ,, chainless	£1,280
30 ,, 6 ,, ,, ...	£1,330
50 ,, 6 ,, ,, ...	£1,400

The prices of the bodies range from £50 to £250.

To the above rule, I believe, there is only one exception, *viz.*, the new 18 H.-P. four-cylinder "Napier Popular" which is sold complete for £700.

The following complete estimate may be useful to intending purchasers :—

	£	s.	d.
18 H.-P. Napier Popular complete with side-entrance body...	700	0	0
Cape Cart Hood	35	0	0
2 Spare Dunlop Covers (870 × 90) ...	12	10	2
2 ,, Inner tubes	4	2	6
1 ,, Accumulator	2	5	6
2 Napier Head Lamps	15	0	0
2 ,, Side ,, ...	4	0	0
1 ,, Tail ,, ...	1	15	0
1 Horn complete	1	10	0
1 Empress Jack	1	8	6
1 Large Tyre Repair Outfit	0	7	6
1 Compound Tyre Inflator and Gauge ...	2	8	6

	£	s.	d.
1 Voltmeter	0	15	6
1 Spare (Castle) Single Trembler Coil ...	2	10	0
1 ,, Mica Commutator Cam	1	4	0
1 ,, Trembler Blade and Screw ...	0	8	0
3 ,, E. T. C. sparking Plugs complete	1	2	6
1 ,, Exhaust Valve complete with case	0	18	0
1 ,, Inlet Valve complete with case.	1	12	0
1 ,, Carburetter Float and case ...	0	8	0
1 Large Copper Petrol Funnel	0	2	6
1 Leather Roll of Tools	2	2	0
1 Pair large Pliers, with Wire Cutters...	0	2	6
6 Spare Links for Chains	0	7	6
Assortment of Springs, &c.	0	10	0
	782	10	2
Cost of Packing Case 15′ × 7′ × 7′-6″ ...	20	0	0
Freight to Bombay by P. & O.	39	7	6
5 per cent. Customs duty at Bombay ...	39	0	0
Incidental expenses, say	4	2	4
Total landed in Bombay	£885	0	0

Messrs. S. F. Edge & Co. have, however, kindly agreed to pay the Customs duty in the case of orders being registered on the "Motor Car in India" order form. The sum of £39 can therefore be deducted by users of the order form—reducing the total to £846-0-0, or Rs. 12,690-0-0.

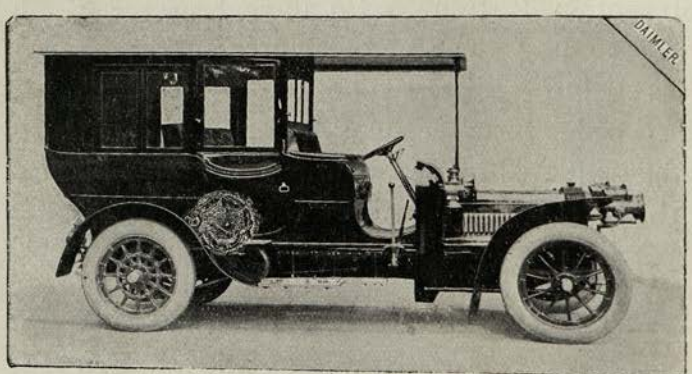
Address—

MESSRS. S. F. EDGE, LTD.,
14, NEW BURLINGTON ST.,
Regent St., London, W.

The Daimler Cars.

The Daimler Motor Company has had the honour of supplying the King with Motor Cars since 1900.

The King's first Daimler Car.



The King's latest Daimler Car.

The continuance of His Majesty's patronage is the best guarantee that the "Diamler" has maintained its position in the front rank of British-built cars. On the opposite page will be found illustrations of the first and the last of six cars built by this Company for His Majesty's private use. These illustrations also serve to shew the progress made in motor car construction during the last four years.

The Daimler engines were, until quite recently, built in two sizes, namely, 18-28 H.-P. and 28-36 H.-P., but last year the Company stopped manufacturing the 18-28 H.-P. engine and introduced two new ones, namely, 30 H.-P. and 40 H.-P. (nominal).

The frame consists of two side members connected by four cross members. The side members are made up of steel flitch plates backed, on the inside forward end, with channel steel for about a third of the frame length, and on the outside rear end with wood for about three quarters of the frame length. The cross members are of channel steel. The frame narrows to the front, giving a wide range of action to the steering wheels.

The engine has four cylinders.

In the	18-28 H.-P.	the bore is	95m.m.	and stroke	130m.m.
,,	28-36 H.-P.	,,	110m.m.	,,	150m.m.
,,	30-40 H.-P.	,,	124m.m.	,,	150m.m.
,,	40-50 H.-P.	,,	135m.m.	,,	150m.m.

In each case the lower horse-power is developed at a speed of from 750 to 800 revs. per minute and

the higher horse-power is only obtained when the engine is accelerated to its utmost.

The accompanying plan of the Daimler chassis will shew the somewhat unusual arrangement of the differential and gear boxes:—

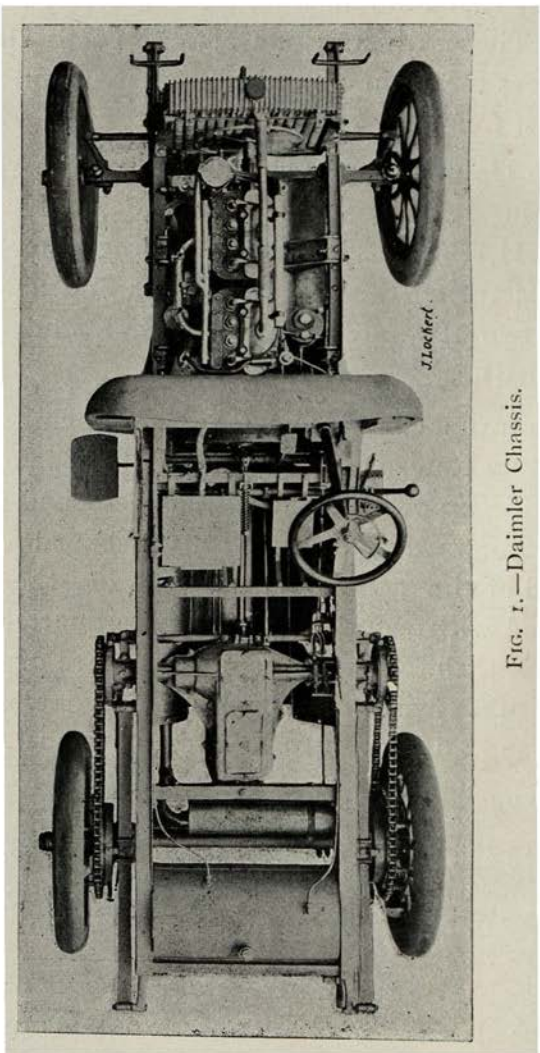
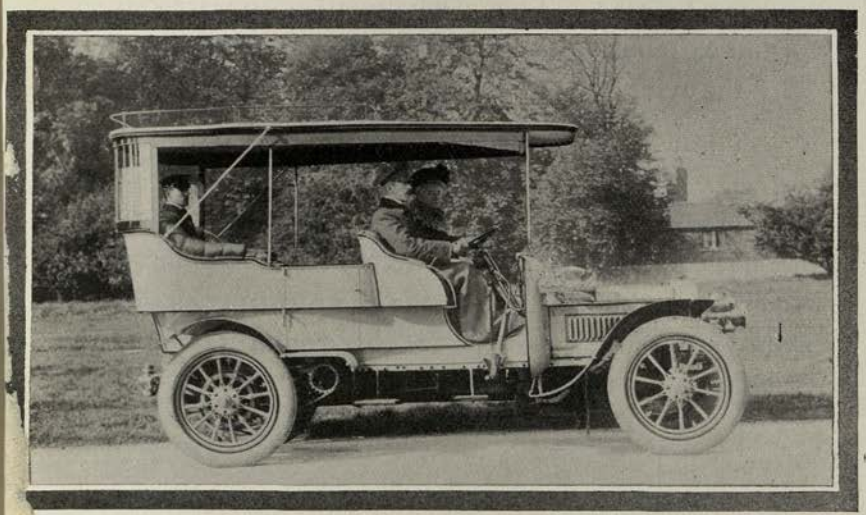
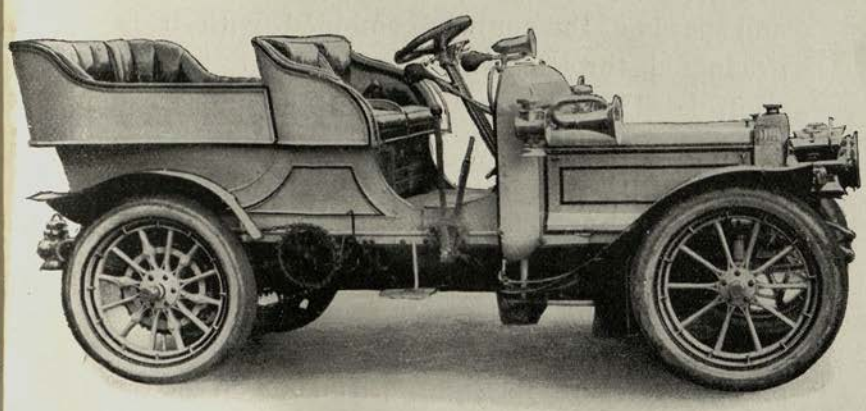


FIG. 1.—Daimler Chassis.



Daimler with Canopy top.



Daimler Tonneau. FIG. 2.

The cylinders are cast in pairs with a water jacket to each pair. Each piston is fitted with four rings, two in each groove. The sparking plugs are inserted above and to the left of the cylinders, and fire the cylinders in rotation from

front to rear. The mechanically operated inlet and exhaust valves are also on the left hand side of the cylinders. These valves are interchangeable.

The water jackets which allow the water to pass freely all round the cylinders are closed above the cylinders by aluminium covers, and above the valves by steel plates. The cold water enters the jacket at the left side near the top, passes out at the top and thence to the radiator. A fan mounted behind the radiator assists the cooling process. The water pump is of the centrifugal type, and of large capacity.

The carburetter is of new and special design and gives a positive regulated mixture at all loads and speeds of the engine; combined with it is a graduated throttle which is actuated by hand control. The ignition is on the high-tension system, employing only one coil and trembler, and one low-tension timing brush. The high-tension system can, however, be fitted at an extra charge of £25 if desired.

The system of lubrication is most efficient. A large reservoir on the right side of the engine supplies, by pressure, the sight-feed oil box on the dash board, from thence the oil passes through three sight-feed lubricators to the engine, cylinders, and crank-chamber; all other bearings are self-lubricating.

The petrol tank is made of copper, and holds 14 gallons in the case of the smaller engine and 16 gallons in the case of the larger engines.

The clutch is controlled by a foot pedal in the usual way. The fly-wheel forms the female

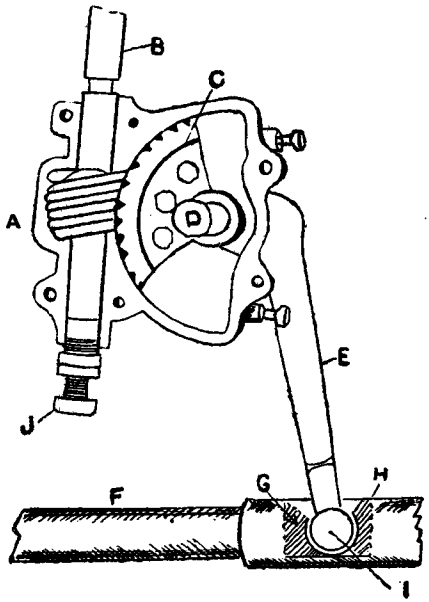


FIG. 3.—Daimler Steering.

portion, the male portion being a light aluminium cone covered with leather. The method of adjustment is exceedingly simple, and is done by means of a nut which will be found at the forward end of the clutch-spring, immediately below the foot-board.

The steering gear is of the usual worm and segment irreversible type.

Fig. 3 shews the mechanism with the worm and segment cover removed. The worm screw A, being fixed to the steering column B, communi-

cates the movements of the hand steering wheel to the toothed segment C. If C is rotated in an upward direction, the steering lever E is thrust forward, carrying the steering rod F with it. In figure 2 the lever E will be seen projecting below

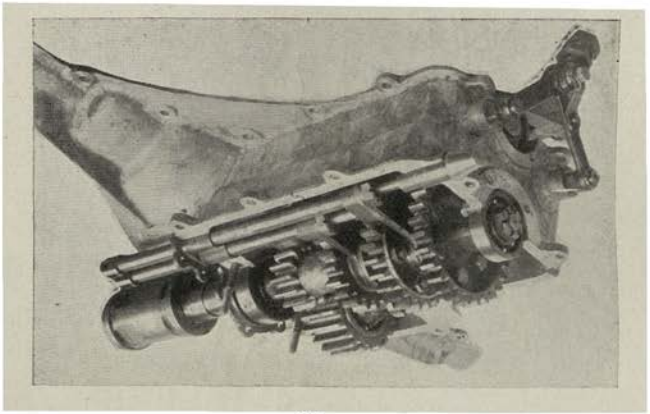


FIG. .

the dash board, and the rod F connecting its lower end with the steering axle. The ball end I of the steering lever is enclosed in two hollowed out blocks G and H. Springs behind these blocks prevent shocks at the steering wheels passing to, and damaging, the steering mechanism. The shaft D, to which C and E are fixed, is strong and well-supported. A thrust lock screw J enables any adjustment between A and C to be made without difficulty. The principles of the Daimler method of transmitting the engine power to the road wheels will be found reproduced, with slight modifications, in a great many of the well known cars of to-day. A propeller shaft connects the clutch and the primary shaft. Fig. 4 shews the

lower half of the gear box removed, shewing the primary shaft pinions, and the rods from which project the arms by which the pinions are caused to slide on the squared primary shaft.

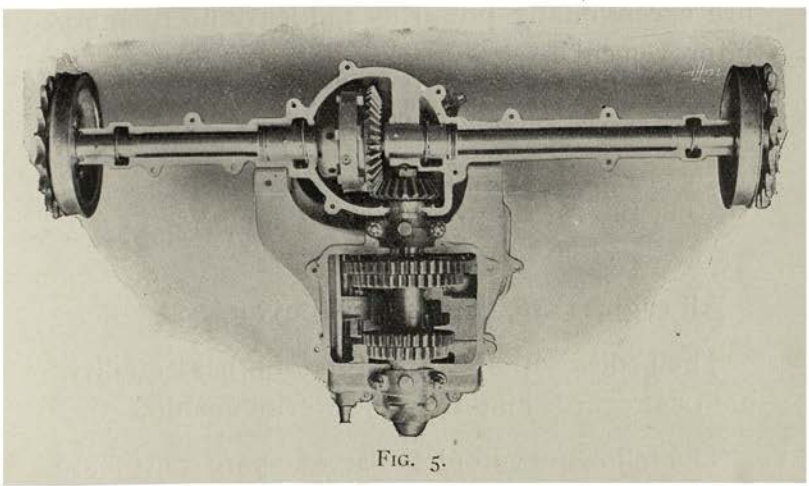


FIG. 5.

In Fig. 5 the upper half of the gear box is removed, shewing the secondary shaft pinions. This figure also enables the general arrangement of the driving bevel, differential, countershaft, countershaft brake drums, and countershaft sprockets, to be easily seen.

If the reader has studied Chapter II, he will have no difficulty in following the various changes of speed, and the consequent effect on the two halves of the countershaft. The countershaft sprockets are connected with the driving wheel sprockets by roller chains of $1\frac{1}{4}$ inch pitch. One of the advantages of the chain drive, likely to appeal strongly to Indian motorists, lies in the fact that

by the fitting of different sized sprockets (a very simple matter), the car can be geared high for fast work in the plains, or, on the other hand, geared low for touring in the hills. The brakes are exceptionally powerful and leave no room for improvement.

Prices, according to body.

28 H.-P.	from	£ 700	to	£ 840
30 ,,	,,	£ 800	,,	£ 940
40 ,,	,,	£1,000	,,	£1,140

All engines are built with four cylinders.

The bodies supplied are of the highest quality, both as regards materials and workmanship.

The following complete list of spare parts are recommended, where several cars of the same type are in use :—

LIST OF RECOMMENDED SPARE PARTS.

Set of Countershaft Brasses.
Set of Connecting Rod Brasses.
Set of Camshaft Brasses.
Four Valves.
Piston complete with Pin and Rings.
Set of Engine Springs.
Set of Sparking Plugs.
One Commutator.
Set of Gears for Driving and Countershaft.
Set of Gearcase Bearings.
Driving Shaft.

Countershaft.
Striking Forks (Long and Short).
Bevel Wheel on Cross-shaft.
Set of Differential Pinions.
Bearings for Cross-shaft.
One Clutch with Leather, Ball Races and Spring.
Pair of Sprocket Pinions.
Pair of Driving Chains.
Pair of Radius Rods.
Coil and Tremblers.
High and Low Tension Wire.
Supply of Piston Rings (say 24).

The cost of packing cases, and packing, naturally varies according to the type of carriage being despatched. In the case of the Daimler cars the sum would range between £15 and £25. As mentioned elsewhere, this firm have agreed to pack and put on board free of charge any car ordered by a private individual on one of the "Motor Car in India" order forms. The purchaser therefore benefits by this agreement to the tune of from £20 to £30. The shipping charges on these cars can be easily calculated; the dimension of packing cases being approximately :—

Four seated 18-22 H.-P. Tonneau.

Length of case...	12	ft.	7	ins.	}	Cubical contents
Width ,, ...	6		0	,,	}	approximately
Height ,, ...	6		4	,,	}	480 c. ft.

The P. & O. Steam-ship Company would therefore charge £24 for freight from London to Bombay on this car.

Closed car Marlborough type on long chassis:—

Length of case...	14 ft. 6 ins.	Cubical contents approximately 760 c. ft.
Width ,, ..	6 ,, 0 ,,	
Height ,, ...	8 ,, 8 ,,	

Freight as above, £38.

Address—

THE DAIMLER MOTOR COMPANY,

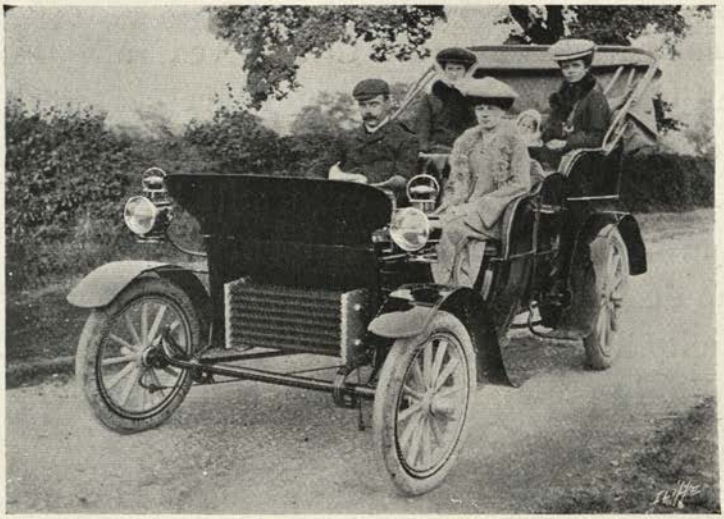
DAIMLER WORKS,

Coventry.

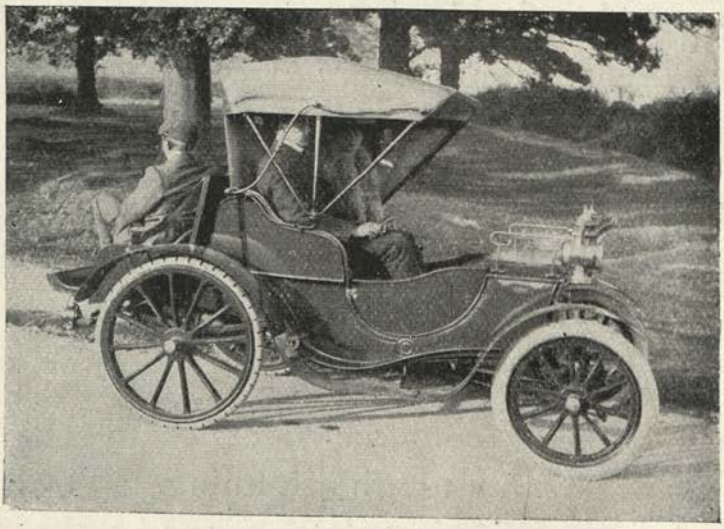
Duryea Power Carriages.

These cars have forced themselves into prominence by their extraordinary successes in open competitions, having defeated cars of all sizes up to 30 H.-P., and several of even still higher power. They are constructed on sound principles, and of unique design. A moderate price, combined with simplicity and efficiency, should make these cars exceedingly popular. It is difficult to understand why the demand for them is not greater than it is. One reason, I think, is that the unusual lines on which the carriage bodies are built arouse suspicion in the minds of the uninitiated. The absence of the almost universal bonnet startles them, and they turn away timidly and buy cars which resemble more nearly the general run. The Company are prepared to fit wheel steering, and bonnet in front (forming a parcel box), at an extra charge of £25, but few people know this, and those who do, shy at the extra charge. A popular car could be produced, without any alteration to the chassis, by designing a body on more conventional lines and making it a standard pattern. To return to the car as at present built :—

The frame is constructed of channel steel, strengthened with a tough ash filling. As will be seen in the accompanying plates 1, 2 and 3, the front wheels are well in advance of the frame (which narrows in front) and are connected to it by semi-scroll springs, hinged to the underside of the



15 H.-P. Duryea Tonneau.



12 H.-P. Duryea Dog Cart Phæton.

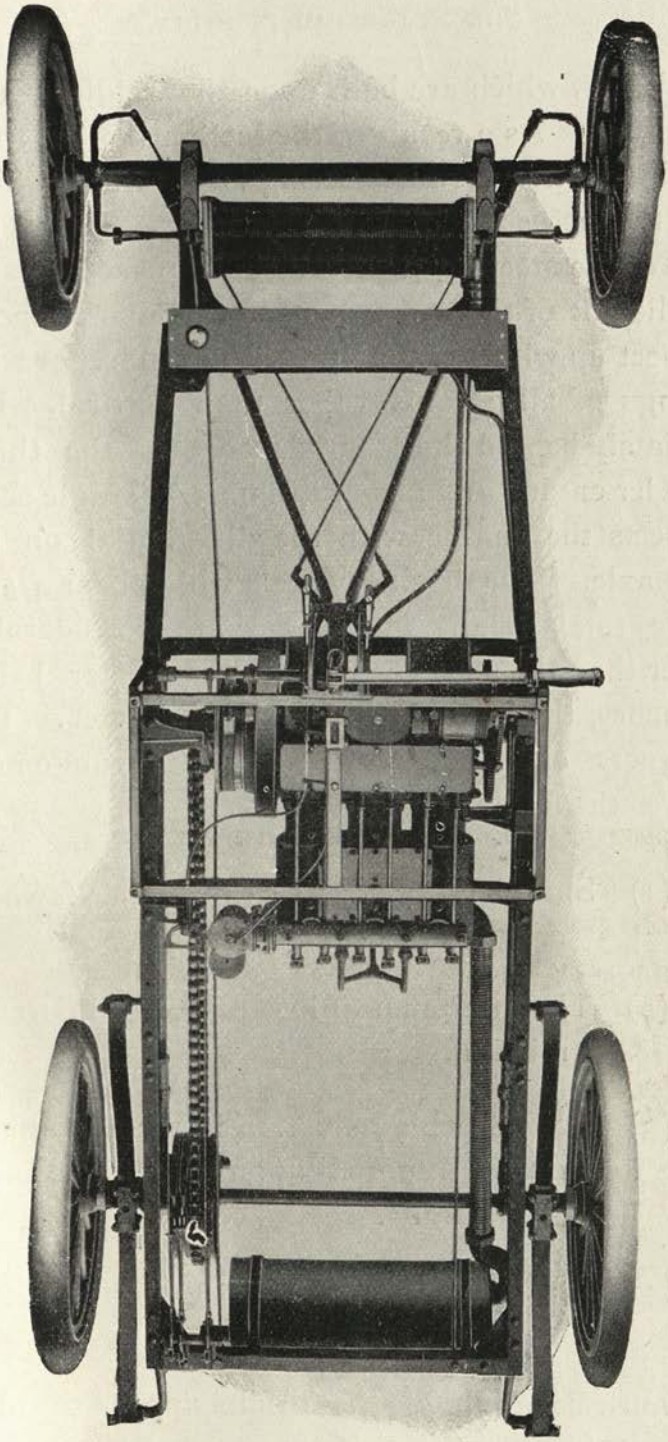


FIG. 1.

head lugs, which are built upon the weldless steel axle tube. As a result of the inclination of these head lugs, irreversible steering is obtained, without the necessity of worm gearing. From the base of the steering post, which is placed on the middle line of the car, two strong tubular supports connect up with the axle tube, and so relieve the springs of all strains other than vertical. Immediately behind the steering post is the three-cylinder engine and power drum. A single chain connects the engine with the differential on the back axle. The driving wheels which bear 4/5ths of the total weight of the car are considerably larger than the steering wheels, the former being 36 inches, the latter 30 inches in diameter. The designers claim that the above arrangement secures the following advantages :—

(1) Simplicity of construction, and fewness of parts.

(2) The minimum of loss of power in transmission.

(3) Considerable reduction in the amount of strain imposed upon the frame and connections.

(4) Higher horse-power at the wheels, per weight of carriage.

It must be admitted that results appear to fully bear out the above assertions.

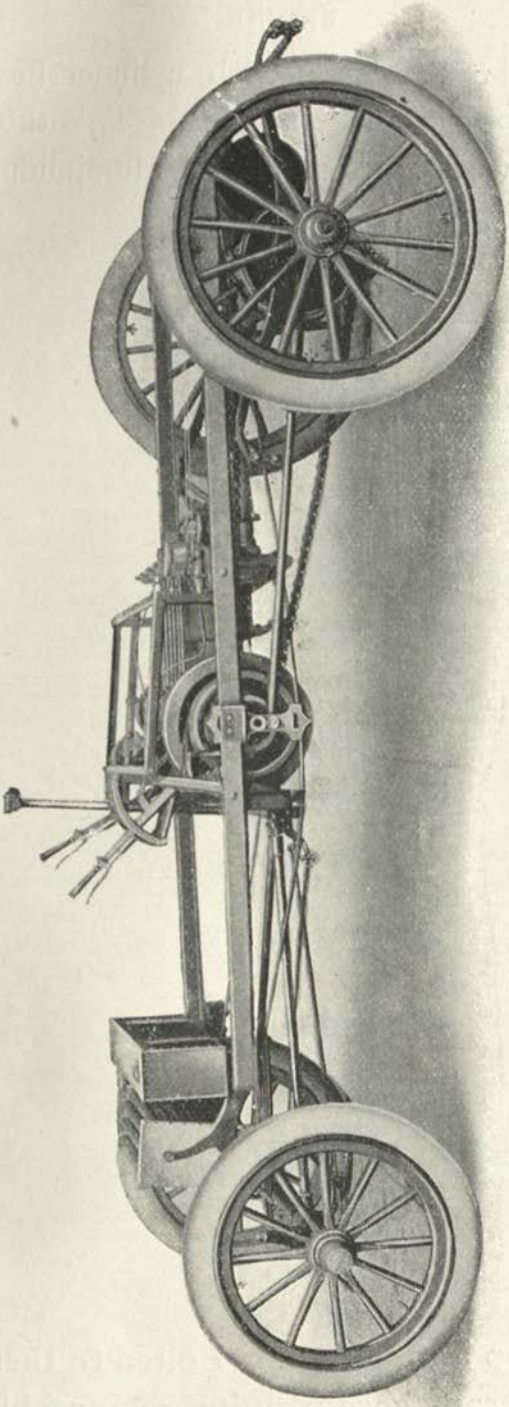
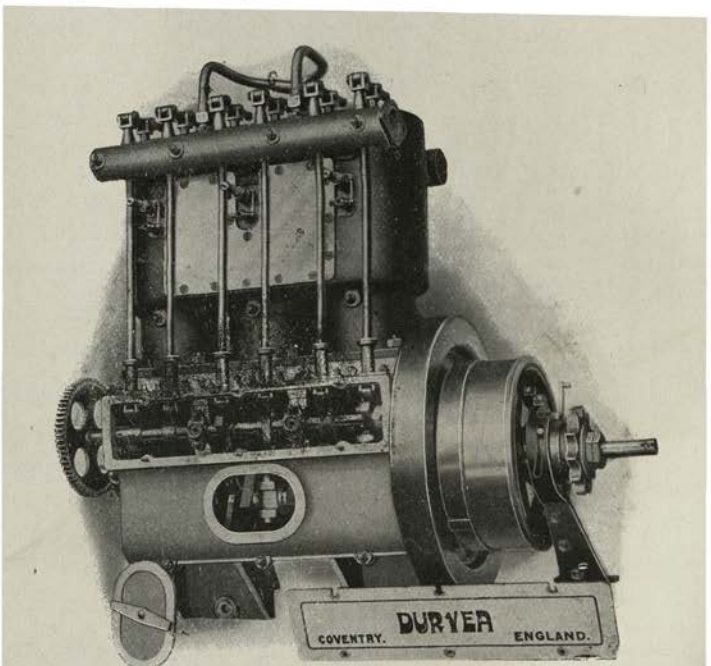


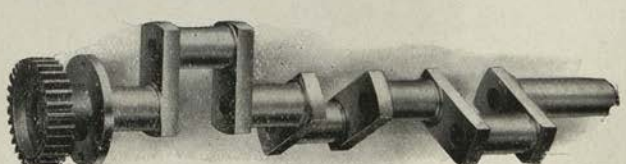
FIG. 2.—DURYEA.

ENGINE.

The three cylinders A with cylinder heads and jacket BB are cast in one piece without any joints; the water jackets have aluminium covers



ENGINE.



CRANKSHAFT.

bolted on top and bottom. Bolted to them is the aluminium crank case with its removeable cover. Should it be necessary to take out the pistons,

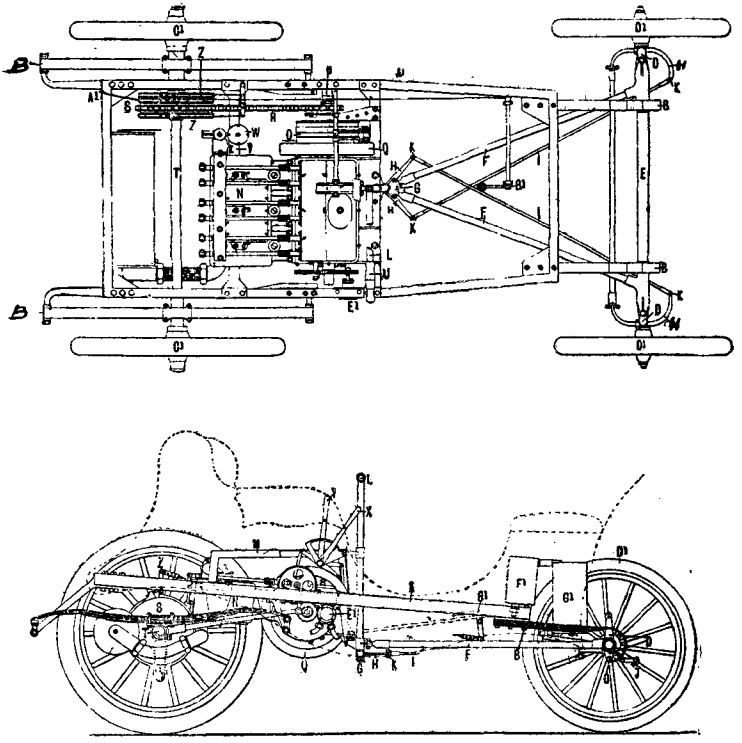


FIG. 3.

A—Frame.
B—Springs.
C—Brackets.
D—Head Lugs.
E—Axle.
F—Supports to Axle.
G—Steering Post.
H—Steering Arms.
I—Steering rods.
J—Steering horns.
K—Steering connections.
L—Steering handle.
M—Seat frame.
N—3 Cylinder engine.
O—Power drum.
P—Power drum bearing.
Q—Fly-wheel.
R—Chain.
S—Differential.
T—Back Axle.
U—Twisting grip on Steering handle.
V—Throttle Lever.
W—Carburetter.
X—Clutch lever.
Y—Reversing lever.
Z—Brakes.
A1—Differential brake.
B1—Differential brake lever.
C1—Driving wheels.
D1—Steering wheels.
E1—Pump.
F1—Water tank.
G1—Radiator.

the cover, with all the valve gear of the engine undisturbed, can be removed and readily replaced. The bore and stroke are the same, *viz.*, 4 inches, the 12-H.P. engine giving its power at 600 revolutions, the 15-H.P. at 750. The crank-shaft H is set in advance of the cylinder axis (see Fig. 4, lines MM and NN), the effect being to obtain a more direct thrust on the driving stroke.

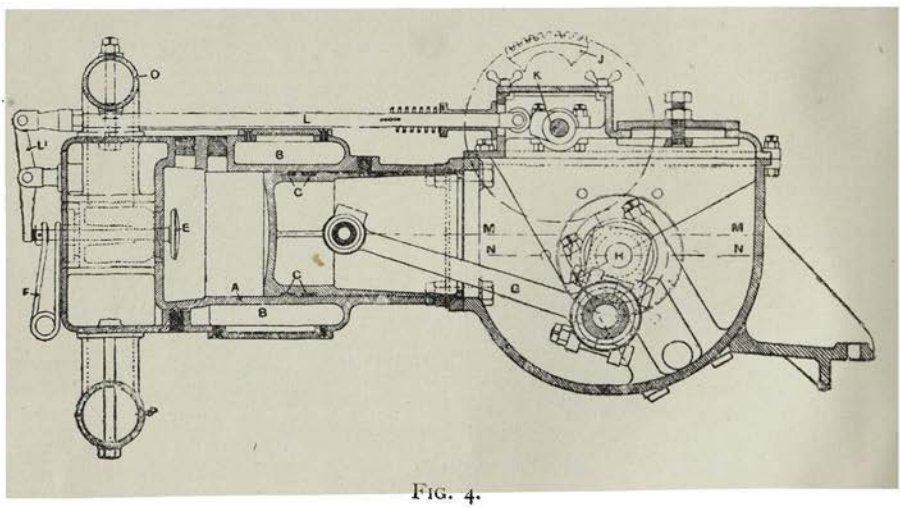


FIG. 4.

The crankshaft is forged solid, and has the cranks set at 120°, and the connecting rods G are furnished with oil cups to feed the crank-pins. The engine is lubricated by pressure feed from the exhaust, automatically put into operation by the act of starting the engine. One camshaft K works both the inlet valves D, and the exhaust valves E, through the rods L and L1, and the closing rods F.

PETROL SUPPLY.

The carburetter is placed on the left of the engine head, and supplies the cylinders by means of one short feed pipe. The float chamber is fed from the tank by gravity, and regulates the supply to the jet, which in turn feeds the mixing chamber. This is divided into three compartments—the lowest the air chamber, the middle the piston chamber, and the top the mixture chamber. The piston is hollow and has triangular openings cut in its sides. The inspiration of the engine sucks up the piston chamber, and the openings rise above the encircling cylinder, at the same time the air is drawn through a perforated cap over the jet, which rises and falls with the piston. The mixture of gas and air, regulated by the size and number of the openings exposed, is thus proportionate to the needs of the engine at all speeds.

IGNITION.

The Duryea Company have now adopted the high-tension electric ignition with batteries, coil, commutator, and sparking plugs as their standard fittings, but are prepared to fit the Duryea-Dawson high-tension magnets system instead for an extra charge of £5. Or, what is perhaps better, will combine the two, a two-way switch connecting either system with the sparking plugs. Both systems work through the same coil and distributor. The charge for this is £15.

WATER CIRCULATION.

The engine is cooled in the usual manner by means of a water jacket and radiator, circulation

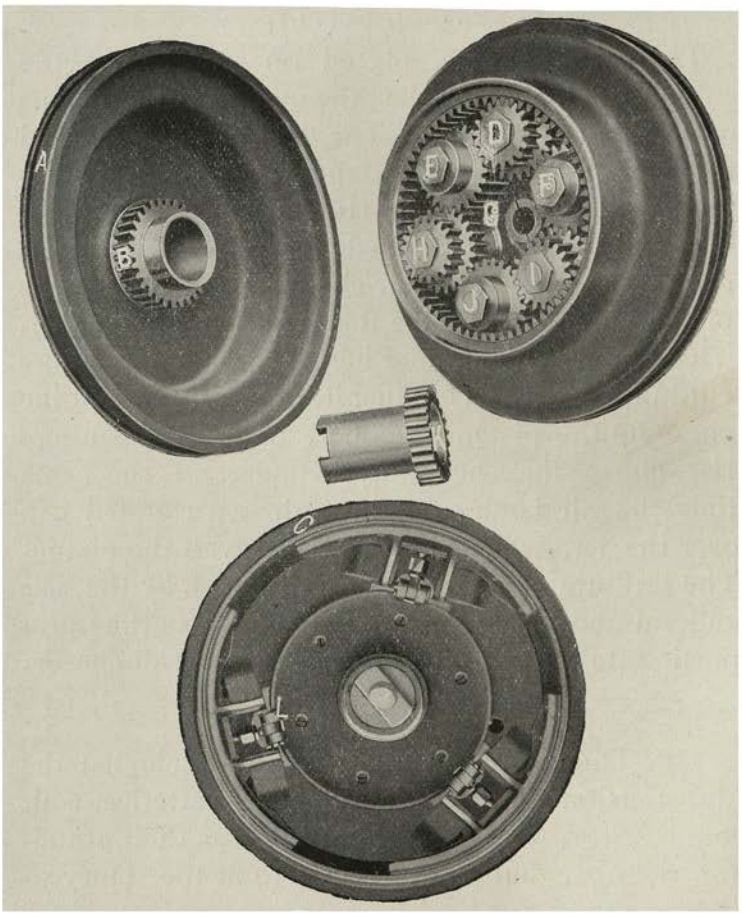


FIG. 5.—THE DURYEA EPICYCLIC GEAR AND CLUTCH.

A, Brake drum for secondary sun pinion.
B, Secondary sun pinion.
C, Annulus brake and clutch drum.
D, H, and I, Secondary pinions.
E, F, J, Primary pinions.
G, Annulus.
K, Driving pinion.
L, Clutch and pinion carrier.

being maintained by a gear driven pump. The radiator is of novel design, and said to give excellent results.

GEAR AND TRANSMISSION.

We have now got to that portion of the mechanism of the Duryea which differs so widely from the generally accepted methods, and the study of which appears to furnish the clue to the remarkable performances of cars driven by comparatively low-powered engines.

The Duryea power drum contains the epicyclic gear and clutch.

The driving sprocket is carried on the extension of the pinion carrier L. The driving pinion (or primary sun) K is secured to the crankshaft, and engages with the three primary pinions E, F, and J. These in turn engage the larger diametered portions of the stepped pinions D, H, and I. The smaller diametered portions of the secondary pinions engage with the secondary sun pinion B and also the annulus G, thus completing the train. If, now, the clutch H be expanded, the pinion carrier and the annulus are locked together. The primary pinions cannot revolve round their axes, so we have the central driving pinion locked also; the whole mechanism revolving as one piece giving a direct drive from the crankshaft to the sprocket.

Again, if K be revolved and pinion carrier fixed, the pinions D, H, and I will revolve round their own axes in the same direction as K (owing to

the interposition of the pinions E, F, and J) and cause the annulus G to revolve in the same direction as K and the pinion B to revolve in the opposite direction to K. By locking G or B to the frame of the car and freeing the pinion carrier, the converse of course holds good, namely, when G is locked to the frame, the pinion carrier, and consequently the sprocket, are driven in the opposite direction to the crankshaft; the speed being in proportion to the number of teeth on the driving pinion K and the annulus G. When B is locked to the frame, the pinion carrier will be

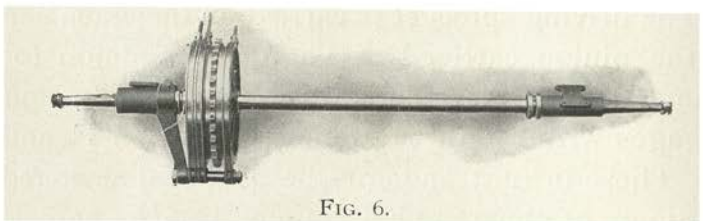


FIG. 6.

driven in the same direction as K, but at a speed reduced in proportion to the number of teeth on K and B respectively. The actual gear reduction is, in the present case, 3 revolutions of crankshaft to 1 of the sprocket on the low gear and 4 to 1 on the reverse. The gear mechanism is substantially made, but the real point is, that, owing to the efficiency of the transmission and flexibility of the engine, the car is almost entirely run on the high gear, when no wear of the gear pinions takes place. A single specially constructed roller chain of 1¼ inch pitch connects the engine and driving wheel sprockets. The rear axle

(Fig. 6) is made in one piece ; one of the driving wheels being mounted on the axle itself, and the other on a sleeve which runs on the opposite end

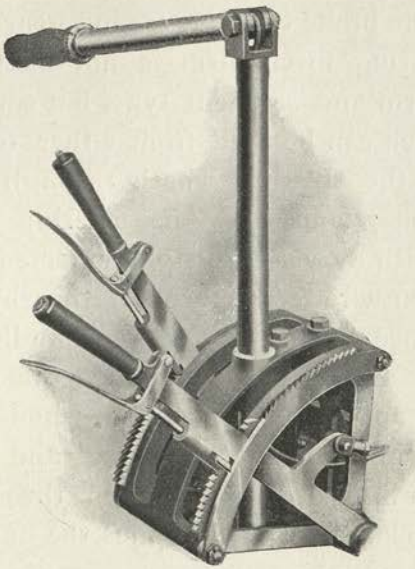


FIG. 7.

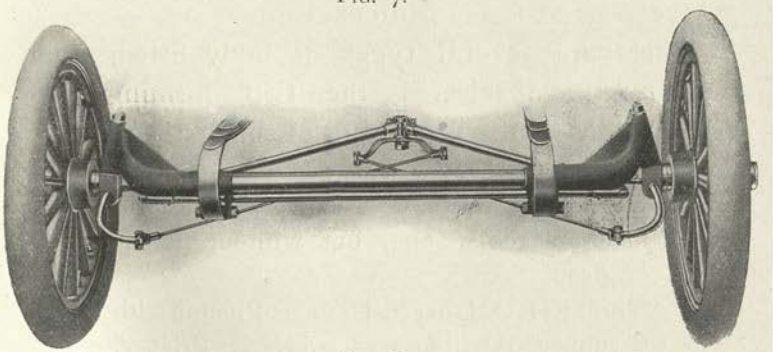


FIG. 8.

of the axle. One-half of the differential gear is fixed to the axle and the other half to the sleeve.

On the halves of the differential are fitted powerful hand brakes. A second brake, actuated by a

foot pedal, is arranged on the extension shaft outside the engine sprocket, and a third brake, supplied by the engine itself, is put into action by applying the brake of the reversing gear.

The steering mechanism is not of the usual wheel, worm and segment type, but consists of a handle which can be used from either front seat, acting on the steering wheels through arms and rods (Figs. 7 and 8). The steering handle is provided with a twisting grip, connected by means of a Bowden wire to the throttle, thereby regulating the pace of the car. The handles to the right of the steering post operates the high and low gears, and slips the clutch when required. The left handle works the reverse and the gear brake when moved backwards on the quadrant, and when pushed forward applies the hand brakes on the differential.

PRICES.

There are several types of body fitted, from which I have selected the two forming the illustrations at the beginning of this article :

The 15-H.P. Duryea Power Tonneau, with rubber mats, side and tail lamps, jack, horn, repair outfit, tools, etc., but without hood. Price £500.

The 12-H.P. Duryea Dogcart Phæton with hood, rubber mats, lamps, horn, &c. Price £ 420.

Address—

THE DURYEA COMPANY,
DURYEA WORKS, WIDDRINGTON ROAD,
COVENTRY.

The Gladiator.

This is a much appreciated type of car which has demonstrated during past seasons its reliability, speed on hills and level, and economy of fuel consumption. Year by year the manufacturer's efforts have been devoted to the improvement of the Gladiator, with the result that the car, in spite of the keenest competition, still maintains the high position it gained some years ago in the popular estimation.

The engines on all Gladiator cars are of Aster make, and vertically fixed by means of bolts to a rigid channel iron frame, which is in turn secured to the rectangular wooden frame-work, strengthened with steel plates upon which the body is supported and which is carried by the wheels through the medium of the springs. By withdrawing four bolts the motor can be removed altogether from the chassis.

The motor is effected by a spray carburetter ignited by electricity, and cooled by water circulation insured by a pump driving off the flywheel.

The power is transmitted from the motor to the change speed gearing by means of friction cones set one inside the other, but so arranged that the driving shaft is not subjected to any end thrust, as is the case in many other systems employed in automobilism.

The changes of speed, of which there are four, are effected by the successive displacement of four

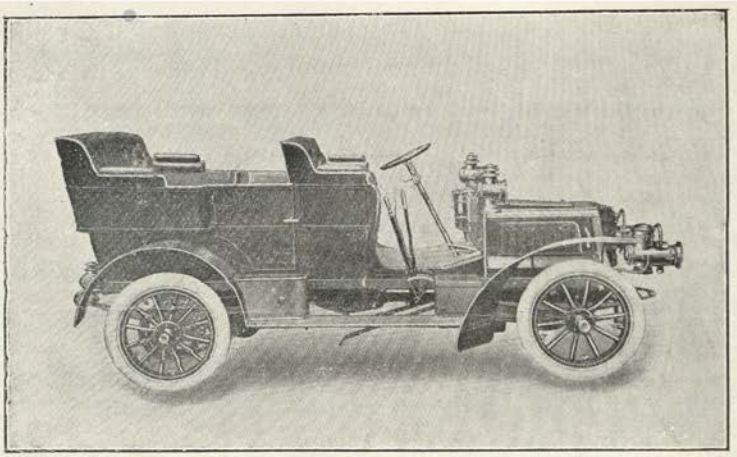


FIG. 1.

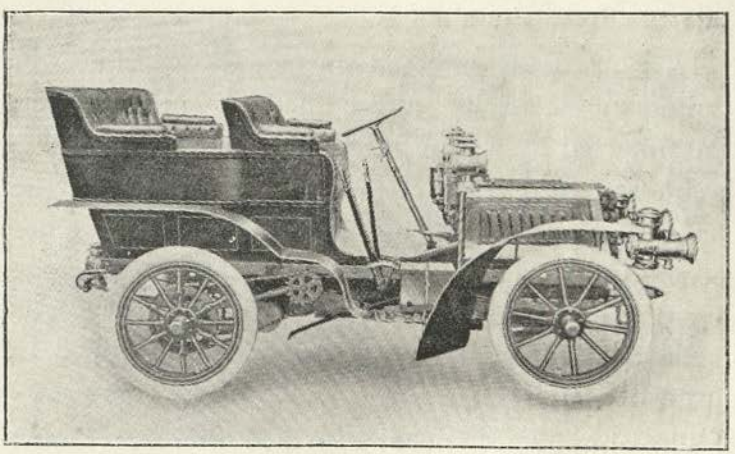


FIG. 2.

gear wheels which engage one in the other with four wheels fixed on the driving shaft. The same lever operates these four speeds and the reversing gear which is obtained by the interposition of a secondary wheel between the two gear wheels of the slow speed. The command of the motor being thus obtained, for more or less speed as required, the movement is transmitted by bevel gearing to the shaft of the differential which carries the chains, which in their turn transmit the power to the driving wheels.

The steering is inclined and controlled by a wheel, the whole apparatus being so contrived that the least touch of the driver acts on the front wheels, but that, on the contrary, the shocks that the inequalities of the road can inflict on the wheels may have no influence on the steering or on the wheel under the driver's hand.

There are two distinct sets of brakes, one being actuated by the right foot and acting upon a large drum on the countershaft, and the other being actuated by a hand lever worked by the driver's right hand and acting on large drums on the driving wheels.

The countershaft brake is a metal to metal contact, but the hand brakes on the driving wheels are lined with a Gandy belting. Both brakes act either forward or backwards, and will hold the car on any hill.

Fixed on the steering column are two levers, one controlling the speed of the engine through the

ignition, and the other regulating the quantity of gas admitted to the cylinders.

A very great feature of the Gladiator is the automatic air regulator to the carburetter. This attachment dispenses with the usual air lever as the suction of the engine regulates the admission of air into the mixing chamber, through the medium of a little piston which works up and down the small cylinder of the regulator, which opens and closes, according to the speed of the engine, the aperture admitting air to the carburetter.

The motor, the valves of which are mechanically operated, is lubricated from the dashboard by drip feeds to the cylinders, and by a small pump which insures that the crank chambers have a sufficient quantity of oil.

The dashboard also carries the grease pump that lubricates the bearings of the differential and gear shafts. The water pump has a special greaser, which, together with the water gauge, which by its action shews that the pump is working, is also fixed to the dashboard.

By the driver's feet are three pedals, one releasing the clutch, the middle one actuating the foot brake, and the right hand one when depressed puts the governor out of action and enables the motor to attain its full power. By the combined action of this pedal, termed the accelerator, and of the clutch pedal, it will be seen that a very

varied control indeed can be obtained over the engine, apart from the regulation of the sparking lever.

The carriage bodies are very roomy and most luxuriously upholstered, while the finish is extremely good—in fact the whole appearance of the Gladiator car is high-class and far in advance of what one would expect at the price these cars are offered at.

PRICES.

9 H.P.	2 cylinder, 4-seated tonneau ...	3 or 4 speed gear Fig. 1.	£300
	extra for side entrance		£25
12 H.P.	2 cylinder, 4-seated tonneau ...	4 speed gear Fig. 2	£350
	extra for side entrance		£25

The chassis prices of 4-cylinder models are—

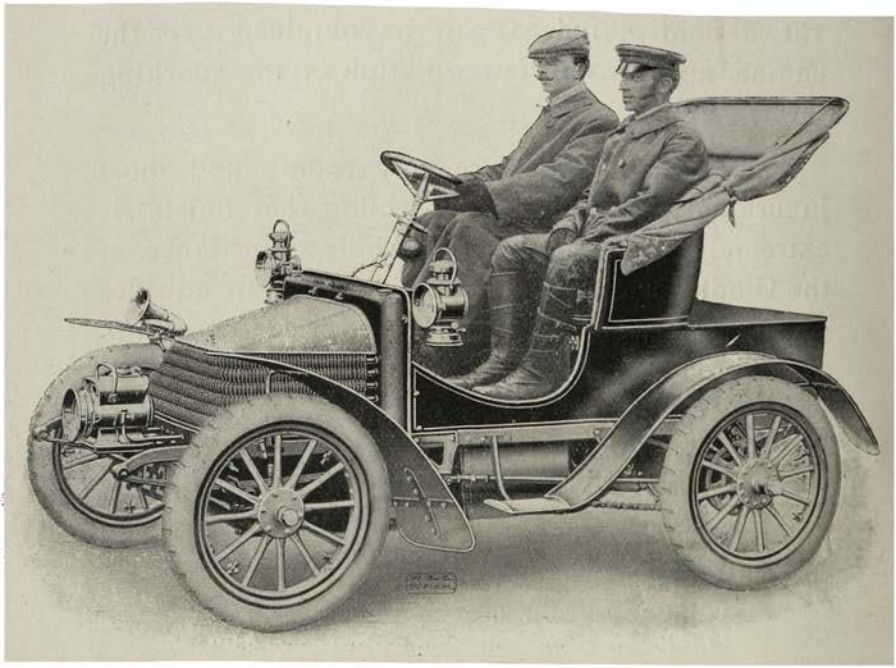
14 H.P.	£425
18 H.P.	£510
24 H.P.	£625

The following extras are supplied for an additional charge of £10-0-0 :—1 set of tools, 1 repair outfit, 1 pair paraffin lamps, horn, pump, rubber mats, 1 set valve springs and 1 set accumulators.

A pair of acetylene lamps with their brackets, as shewn in the illustrations, cost, including fitting, £12-12-0.

Address—

THE GLADIATOR COMPANY,
8 & 9, LONG ACRE,
LONDON, W.C.



WOLSELEY CARS.

The Wolseley Tool and Motor Car Company hold a somewhat unique position in the Motor Trade. They are "Universal Providers" as far as petrol motors are concerned. Pleasure cars are built with an enormous variety of bodies on standard chasses of 6, 8, 12, 16, 24 and 32 H.P. Racing cars up to 96 H.P., Light Railway Petrol Locomotives, Fire Engines, Postal Vans, Delivery Vans, Petrol Electric Generators, Heavy Transport Carts and Lorries, and Military cars for various and special purposes. In every one of the above branches the Wolseley productions are among the first flight.

Three 6 H.P. Wolseley Light Cars ran in the Delhi-Bombay Trials. They all covered the whole distance—880 miles, including three ranges of hills—one car doing so without the loss of a single mark. It should not be forgotten that trials of this nature are much more severe on the cars than ordinary everyday running. Under the latter conditions, an occasional stop to satisfy oneself that everything is all right does not entail any penalty, and may be the means of averting future disaster. In the Herefordshire 1904 Small Car Trials two 6 H.P. Wolseleys were entered. One car obtained the full number of "non-stops," namely 12; the other obtained 11 "non-stops," losing in all 10 minutes owing to want of petrol. The Motor Union of Western India Trials for 1906 produced two Wolseley winners, namely, a 12 H.P. and a 6 H.P. The steady demand for these little cars by business and professional men, to whom the power of rapid movement and punctuality are of equal importance, is a still higher tribute to their strength and reliability. Unfortunately, one of the results of the Delhi-Bombay Trials seems to have been the spreading of an idea among some people that "the car" for India is a four-cylindered car of not less than 16 H.P. and yet India, as compared with England, is flat and therefore more suited to a low powered car.

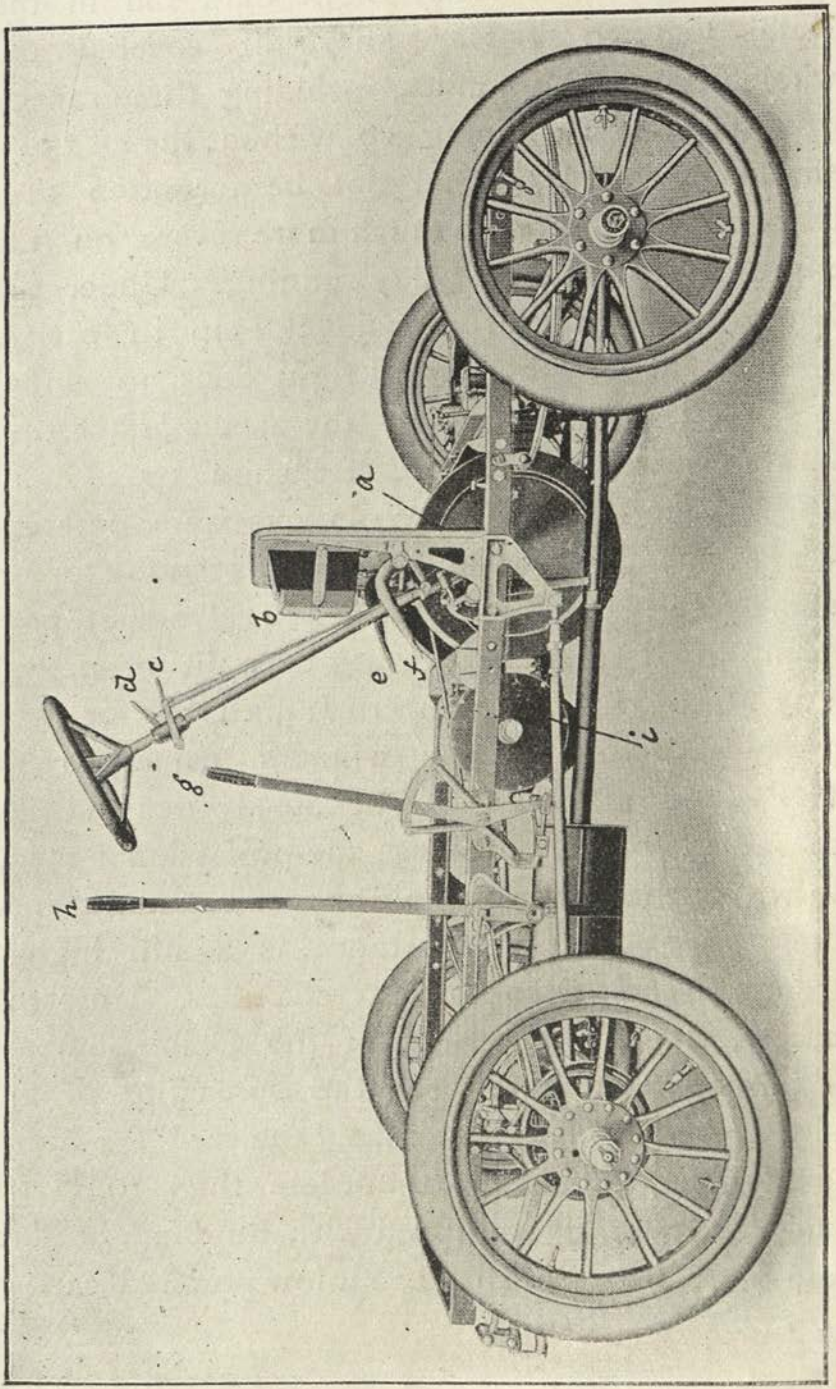


FIG. 1. 6 H.P. Wolseley.

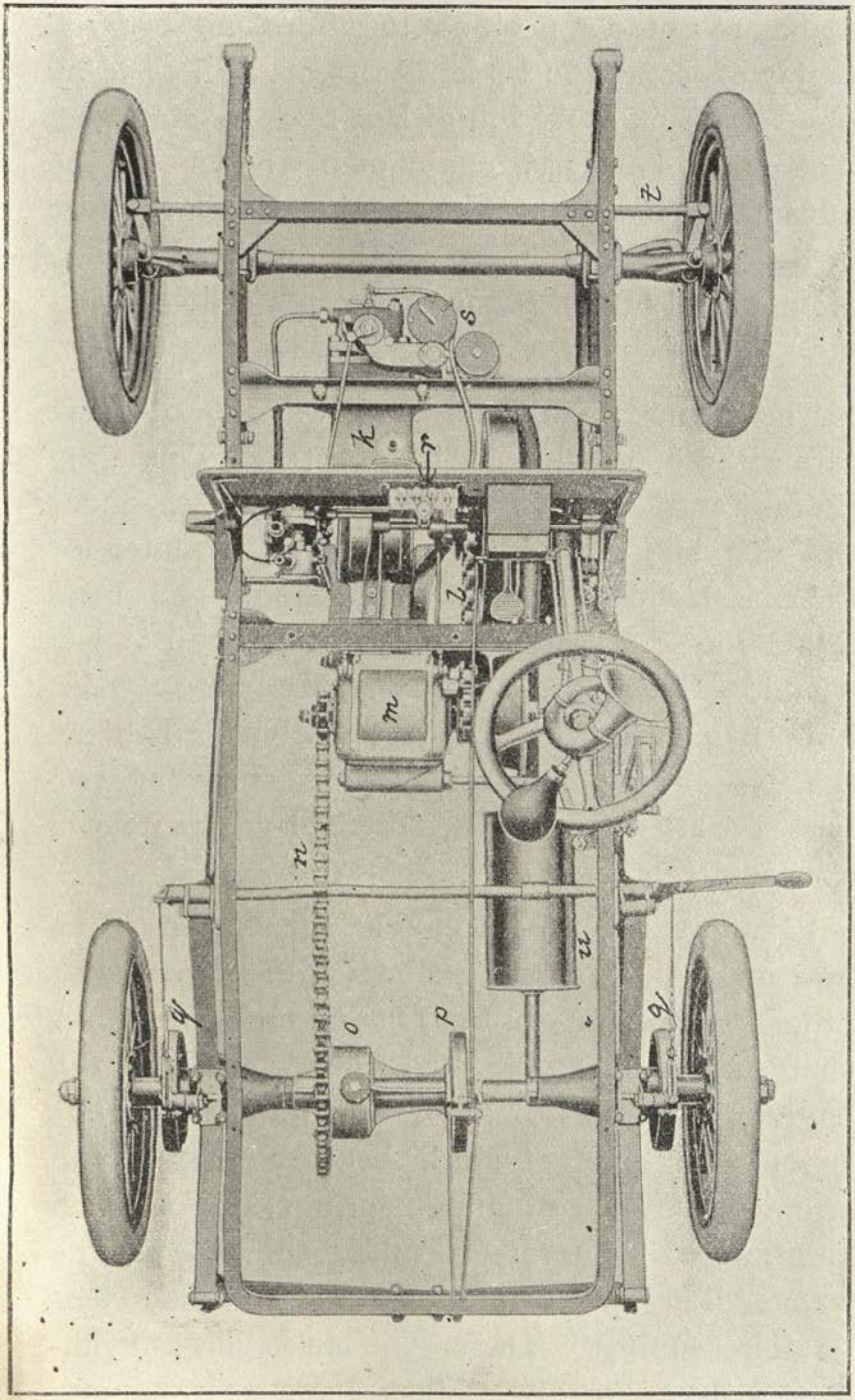


FIG. 2. 6 H.P. Wolseley.

The vast majority of would-be motorists in India are not in a position to afford an original outlay of something like Rs. 15,000, followed by an average monthly bill of Rs. 200 to Rs. 300. There are, however, many men to whom the advantages of a motor car justify the expenditure of Rs. 3,000 to Rs. 4,000 for the purchase, and a monthly bill of Rs. 100 for upkeep.

The 6 H.P. Wolseley Light Car.

The accompanying picture shews one of these cars with hood and head light fitted. These are the only extras, as the Wolseley Company includes the side lamps and horn in the price quoted for the car. As depicted (*viz.*, with hood and head light) the cost landed, duty paid, in Bombay would be Rs. 3,500. Two styles of bodies are built, both two seated, one having no division between the passengers, the others consisting of two bucket seats side by side. Each style has its own special advantages.

Figures 1 and 2 will enable the reader to see how much the Wolseley chassis differs from most other designs. As in the Duryea cars the crank-shaft is parallel to the road wheel axles, and the engine placed horizontally. The frame is strongly built of channel steel, bent to shape, and swung on five semi-elliptic springs, one of which is arranged transversely under the rear of the frame. The springs are long and give very comfortable running. The engine has a single cylinder, with a bore of $4\frac{1}{2}$ inches and a stroke of 5

inches. The normal speed is 800 revolutions per minute which can be accelerated to about 1,000 revolutions per minute. On good level roads an average speed of about 20 miles per hour can be maintained for considerable distances.

The drive is taken from the engine by means of a Renold's chain to the gear box, from thence a single driving chain transfers the motion to the road wheels. The driving wheels sprocket is mounted on the differential gear box.

The foot brakes consists of a band acting on a drum, which forms an extention to the gear box. The hand brakes in a similar manner act on drums mounted on the inner sides of the hubs of the driving wheels.

The following explains the lettering of figures 1 and 2 :—

(*a*) Fly-wheel.
(*b*) Coil.
(*c*) Throttle Lever.
(*d*) Ignition Lever.
(*e*) Brake Pedal.
(*f*) Clutch Pedal.
(*g*) Speed Lever.
(*h*) Brake Lever.
(*i*) Clutch.
(*k*) Engine.
(*l*) Renolds' Chain.
(*m*) Gear Box.
(*n*) Driving Chain.
(*o*) Differential Box.
(*p*) Foot Brake.
(*q*) Hand Brake.
(*r*) Oil Reservoir.
(*s*) Carburetter.
(*t*) Steering Rod.
(*u*) Silencer.

The Wolseley type of bonnet and radiator is distinctive, and a car of this make can be at once recognized.

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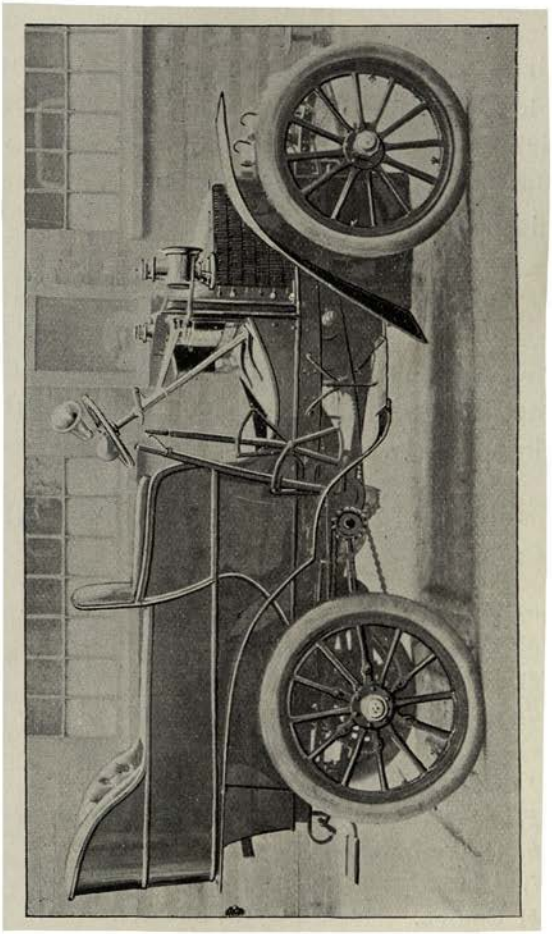
The 12 H.-P. Wolseley Tonneau.

This is an excellent touring car. Many different styles of bodies are built by the makers for this chassis, particulars and photographs of which



are sent to applicants. We here illustrate the standard four-seated tonneau, the chassis having a wheel base of 7ft. 1in. The chassis is built

also with wheel bases of 7ft. 9in. and 8ft. 2 in., the extra cost being £16 and £22 10*s*., respectively.

The motor has two cylinders of the same bore and stroke as the 6 H.-P. engine, *viz*., 4½in. by 5in. The system of transmission is practically the same. In the larger cars the differential shaft passes through the gear box, and has fixed to it one set of speed pinions. The two driving chains are carried on sprockets, one at each end of the differential shaft. There are four speeds and a reverse. The forward speeds are 8, 14, 2: and 29 miles per hour at normal engine speeds. When the engine is accelerated to its utmost, speed of about 35 miles per hour is attainable. The lubrication of all moving parts is effectively maintained by a system of sight feeds and feed pipes. The ignition is by accumulators, coil and commutator. The pace of the engine is varied by means of a throttle lever placed on the steering pillar; this regulates the quantity and quality of the mixture. Expanding brakes are fitted as well as hand brakes. The wheels, intermediate and differential shafts run on ball bearings. Half compression taps enable the engine to be started without exertion.

One acetyline head lamp, two side lamps, and two waterproof aprons are, in addition to the usual fittings, included in the price quoted for this car. The War Office have purchased several of

these cars, some of which, fitted with a special carburetter, are using paraffin with entire success; the disagreeable smell of this class of fuel being the only objection that can be urged against it.

The prices of standard cars delivered in Bombay (duty not included) are—

6 h.p.	1 cylinder	£193
8 h.-p.	2 cylinders	£330
12 h.-p.	2 ,, ...	£437
16 h.-p.	4 ,, ...	£590
24 h.-p.	4 ,, ...	£699

Agents in India—

MESSRS. S. R. LALKAKA—K. & S. CYCLE AND MOTOR CAR CO., BOMBAY.
,, W. LESLIE & CO.—CALCUTTA.
,, LEVETUS & CO.— ,,

Agents for Burmah—

MESSRS. BROWN BROS.—GREAT EASTERN ST., LONDON, E.C.

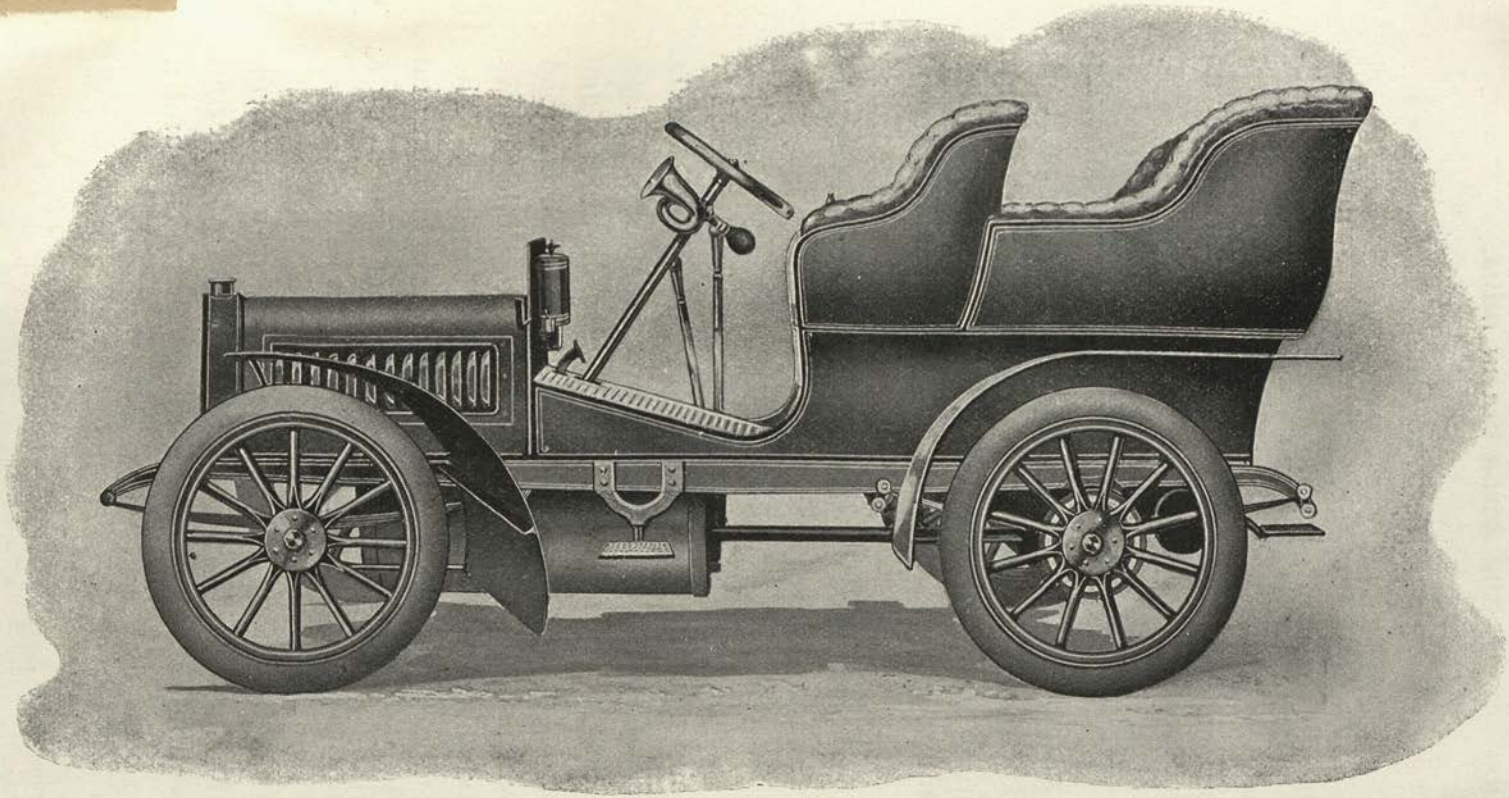
Agents for Ceylon—

MESSRS. J. M. WOTHERSPOON & CO.—23, GREAT ST. HELEN'S ST., LONDON.

Address—

THE WOLSELEY TOOL & MOTOR CAR COMPANY,
ADDERLEY PARK,
Birmingham.

This Company also manufactures the well-known Siddeley Cars.



10-12 H.-P. Argyll Tonneau.

Argyll Cars.

The "Argyll," one of the best known of British built cars, is justly renowned for the great simplicity of its mechanism and the ease with which it can be handled even by a person with little or no mechanical knowledge.

These cars are built in two, three and four cylinder models, rated at from 10 H.-P. to 24 H.-P. The engine is a vertical one, set under a bonnet in front. The clutch is arranged in the fly-wheel, and the gear box, which is an especially strong feature of the "Argyll," is constructed according to the patented designs of Mr. Alec. Govan, the Managing Director.

The drive is by Cardan shaft (with universal joints at each end) and bevel gear to the live axle. The frame of the car is of pressed steel of ∩ section, designed with a view to lightness and strength. In the latest models the front road wheels are carried on ball bearings, while the live axle is supported by four roller bearings. The radiator is arranged across the frame in front and is of the honeycomb pattern. It is assisted by a fan driven from the crankshaft by a belt.

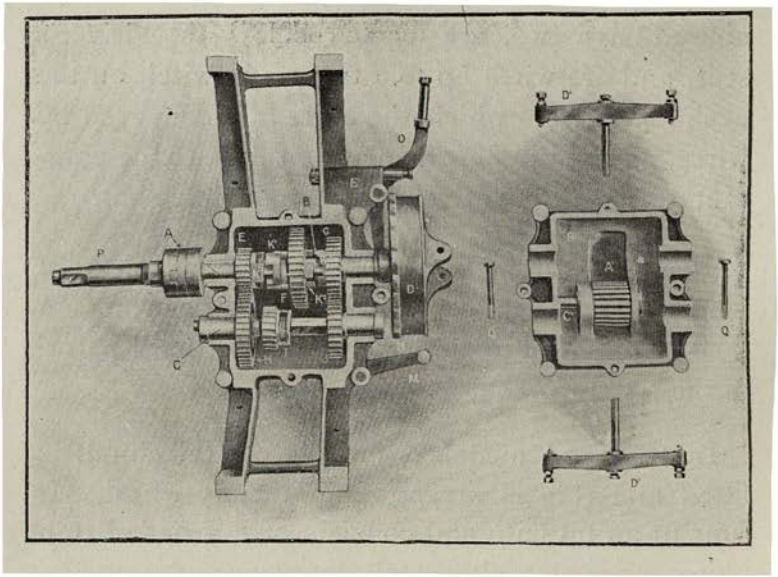
In the two-cylinder 10-12 H.-P. car no pump is fitted, the water being circulated by Thermo-syphon action. This cooling system is found to be perfectly satisfactory.

The ignition is by accumulators, induction coils, wipe contact commutator, and high tension sparking plugs. The accumulators, of which it is advisable to have two, are located below the driver's seat, and are wired up to a two-way switch on the dashboard from which the current is conveyed by wires, encased in fibre insulating tubes, to the commutator, which is driven by the half-time shaft.

Below the front seat is placed the petrol tank. This is of sufficient capacity for 150 miles run. A float is provided to indicate the quantity of petrol in the tank.

In the 1906 models a metal-to-metal clutch is fitted and this is arranged in the fly-wheel. It runs in an oil bath and consists of a series of thin plates, engaging alternately by means of pins and projections with the driving disc. The plates are held in frictional contact by coil springs, and are released by the action of a push pedal. There is extremely little wear in this clutch, but what does take place can be readily taken up.

As this clutch runs in oil it needs but little attention, and, unlike the leather variety, it cannot be damaged by slipping. If desired, the car may be allowed to move quite slowly while on the top gear—the clutch slipping and engine running at its normal pace. This is especially useful when driving the car in traffic, as it obviates the annoyance of constant gear changing.



A Universal Sliding Coupling.
B Main Shaft
C Counter Shaft
D Brake Drum and Sprag Ratchet
E 3rd Speed Pinion and Shaft
F 1st ,, Wheel
G 2nd ,, ,,
H Counter Shaft Speed Wheel
I 1st Speed Pinion
J 2nd ,, ,,
K 3rd ,, Clutches
K1 3rd ,, Engaging Clutches
K2 2nd ,, ,, ,,
K3 2nd Speed Clutches.
L Actuating Fork (Main Shaft)
L1 ,, ,, (Counter Shaft)
M 1st Speed Bell Crank
N Sprag Ratchet
O 2nd and 3rd Speed Bell Crank
P Clutch Shaft
Q Bearing Joint Bolts
A1 Reversing Pinion
B1 Gear Box Cover
C1 Reversing Spindle
D1 Gear Box Cover Clamps
E1 Gear Box

GEAR BOX.

The gear box on all "Argylls" is of the same design. Three speeds forward and a reverse are provided, the top speed being a direct through drive. The accompanying figure shows the box with lid removed. The dog clutch A is driven by the engine. This part is in one with the wheel E and is discontinuous with the square shaft carrying wheel F and brake drum D. As shown, the gear is in the neutral position. When clutches K and K^1 are meshed by moving F on square shaft, the top speed is obtained, meantime the counter shaft C runs idle as does also the loose wheel G and half clutch K^3. To obtain the second speed wheel F is moved on square shaft, so that clutch K^2 meshes with K^3, and the drive is now from pinion E to wheel H, and by shaft C to wheel J, and from it to wheel G, and by clutches K^3 and K^2 to wheel F, which, being on a square shaft, causes it to rotate and drives the car. To get the first speed the pinion I is slipped along the square counter shaft until it meshes with F, and the drive is then got from E to H and from I to F. The reverse is obtained on slowest speed by carrying the long idler wheel A^1 into mesh with I and F.

The great feature of this box is the provision for changing the gears. The lever, which is used to slip wheel F, is discontinuous at one point, and acts through a couple of spring links. The effect is, that if, when the handle is pushed home, the

clutches do not happen to be in line, there is none of the clattering and grating experienced with some gears. The springs in the flexible lever are simply extended, the change speed handle goes fully over at once, and as soon as the clutch prongs come opposite the corresponding spaces, the springs act and pull the clutches fully into mesh.

BACK AXLE.

The "Argyll," being a gear driven car, is fitted with a live axle. This consists of right and left hand portions with the differential or compensating gear arranged between them. The drive is conveyed from the gear box by the cardan shaft to the bevel gear in the back axle, and the motion thus given to the bevel wheels, on the end of the nickel steel shafts, rotates the road wheels.

The running portion of the axle is supported within the case by the roller bearings. The whole space around the wheels and shaft is filled with solidified oil, forced in by a grease injector supplied for the purpose.

The prices are as follows :—

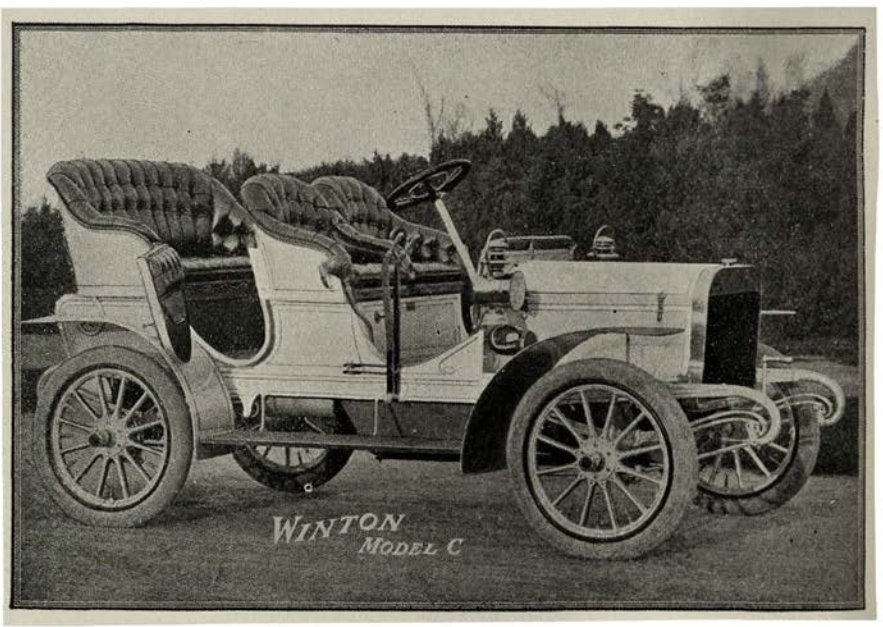
H.P.	Engine.	Body.	Complete.	Chassis only.	
10-12	2 CYLINDER ARGYLL-ASTER...	... TONNEAU	£350	£315	
10-12	2 ,, ,, ,, ...	... DELIVERY LORRY	£335	£325	
10-12	2 ,, ,, ,, ...	... DELIVERY VAN	£350	£325	
10-12	2 ,, ,, ,, ...	... SIDE ENTRANCE	£380	£342	
10-12	2 ,, ,, ,, ...	... WAGGONETTE	£390	£342	
10-12	2 ,, ,, ,, ...	... DETACHABLE BROUGHAM	£440	£342	
10-12	2 ,, ,, ,, ...	... LANDAULETTE	£450	£342	
12-14	3 CYLINDER ARGYLL ...	... TONNEAU	£425	£382	10/-
12-14	3 ,, ,, ...	... SIDE ENTRANCE...	£455	£409	10/-
12-14	3 ,, ,, ...	... WAGGONETTE	£465	£409	10/-
12-14	3 ,, ,, ...	... DETACHABLE BROUGHAM	£515	£409	10/-
12-14	3 ,, ,, ...	... LANDAULETTE	£525	£409	10/-
16-20	4 CYLINDER ARGYLL-ASTER...	... SIDE ENTRANCE...	£550	£495	
16-20	4 ,, ,, ,, ..	... DETACHABLE BROUGHAM	£610	£495	
16-20	4 ,, ,, ,, ...	... LANDAULETTE	£630	£495	
24	4 CYLINDER ARGYLL	... SIDE ENTRANCE...	£700	£630	
24	4 ,, ,, ...	... DETACHABLE BROUGHAM	£760	£630	
24	4 ,, ,, ...	... LANDAULETTE	£780	£630	
24	4 ,, ,, ...	... SALOON	£825	£630	
24	4 CYLINDER ARGYLL-ASTER...	... SIDE ENTRANCE...	£725	£652	10/-
24	4 ,, ,, ,, ...	... DETACHABLE BROUGHAM	£800	£652	10/-
24	4 ,, ,, , ...	... DOUBLE LANDAULETTE	£805	£652	10/-
24	4 ,, ,, ,, ...	... SALOON	£850	£652	10/-

Address.—
ARGYLL MOTORS, LTD.,
HOZIER STREET, BRIDGETON, GLASGOW.

Winton Cars.

These well-known American cars differ essentially in design from the general run of British cars.

An enormous number of them are completed every month at the extensive and well-organized factory in Cleveland, U. S. A. This enables the firm to sell their cars at remarkably low prices.



The Winton.

All Winton Cars are constructed with the same general features. In the later types the cylinders are placed vertically, whereas in the 1904 models they were fixed in a horizontal position. The alteration in the position of the engine, from the horizontal to the vertical, has proved a distinct improvement. The accessibility of important parts

has received the most careful and successful treatment. Such parts as the transmission gear, crankshaft, connecting rods, and pistons can be easily and quickly detached, and as easily and quickly replaced. Hand hole covers, which are removed by simply unscrewing a hand wheel, are fitted to the crank and transmission gear cases respectively. The frame consists of two side members, each of one piece channel section pressed steel, varying in depth from 5 inches to $1\frac{3}{4}$ inches. Drop frames carry the engine and gear mechanism, and the two cross tubes, which support the petrol tank in rear, also serve to stiffen the frame. The side members end in horns, which support the outer ends of the semi-elliptical springs.

The engine consists of four vertical cylinders cast in pairs.

Below the engine is a fixed dust shield. The forward end of the crank case encloses cam gears, fan gear, pump gear, and magneto-idler. This arrangement insures perfect lubrication and freedom from dust and dirt. The cooling water is circulated by a gear driven centrifugal pump, and is forced upwards through the cylinder jackets around the carburetter and exhaust valve chambers, and thence to the top of the gilled radiator. Behind the radiator is mounted a gear driven fan, and a secondary fan is cast in the fly-wheel.

Lubrication is insured by means of a roller feed lubricator driven by the engine ; the supply being thus maintained in proportion to the engine speed.

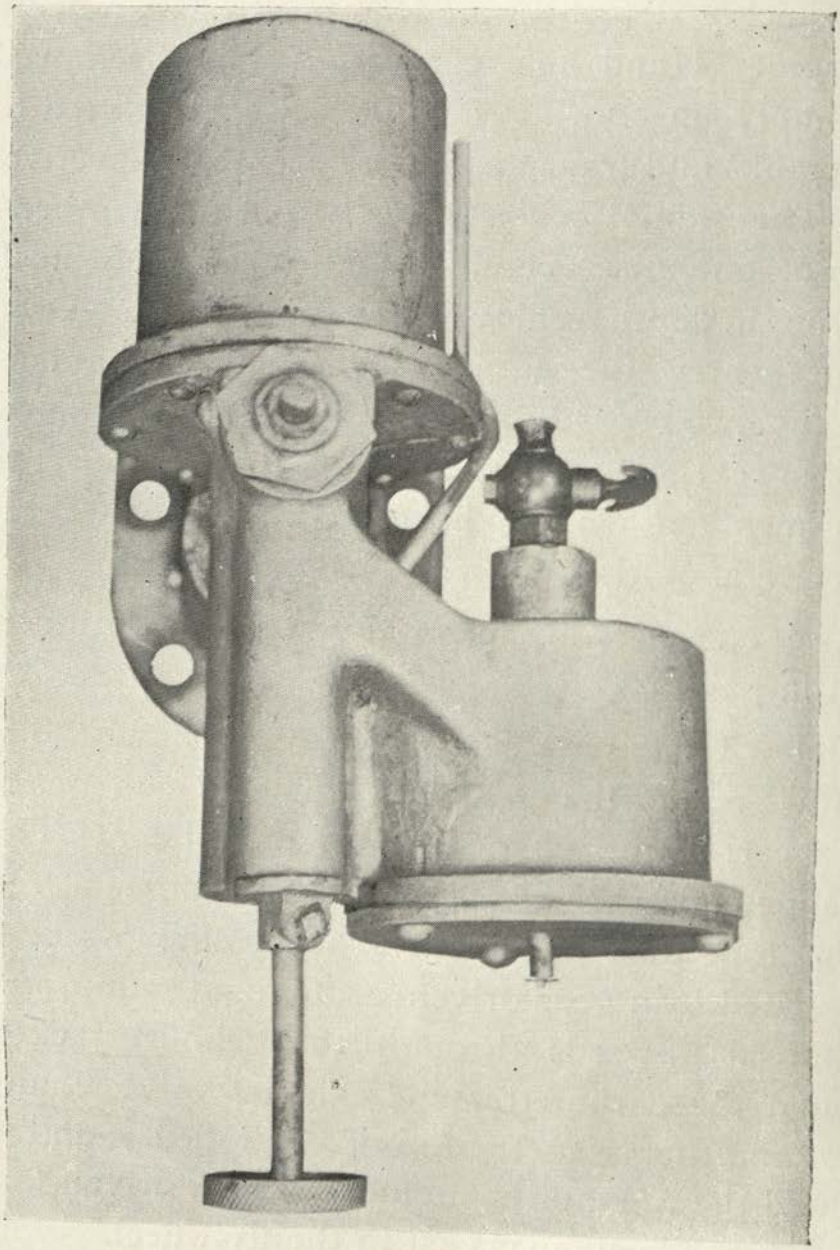


Figure 1 gives a view of the carburetter as seen from the right hand side of the car.

The left hand upper chamber is the float chamber, and to the right of this will be seen the petrol adjusting needle. The fuel is fed to the carburetter, by gravity, from the auxiliary tank. The lower chamber is the mixing chamber. The petrol passes from the top to the bottom of this chamber through gauze screens, is vapourised and mixed with air, and then is drawn into the induction pipe through a valve, which is opened by the suction of the engine. At the opposite end of this valve shaft is a piston which is regulated by air pressure, varying according to the speed of the engine. The amount of gas passing this valve (depending as it does on the lift) is therefore influenced by the speed of the engine. This system of governing is also applied to the inlet valve itself. The result is a very delicate adjustment of the lift of the valves. The manner in which the air pressure on the valve pistons is obtained and controlled is very ingenious. An air pump is driven by the engine, the amount of air pumped into the air-pressure pipes is therefore in proportion to the pace of the engine. These pipes lead to the chambers behind the valve pistons. By providing an adjustable leak in the pipe system, it will be seen that, if the size of this leak is kept constant, the pressure on the valve pistons will be greater or less in proportion to the pace at which the air is pumped into the

pipes. When the engine is running slow, the greater part of the air pumped into the pipes is able to escape through the leak; the pressure on the valve pistons is proportionally light, so that the suction of the engine is able to open the

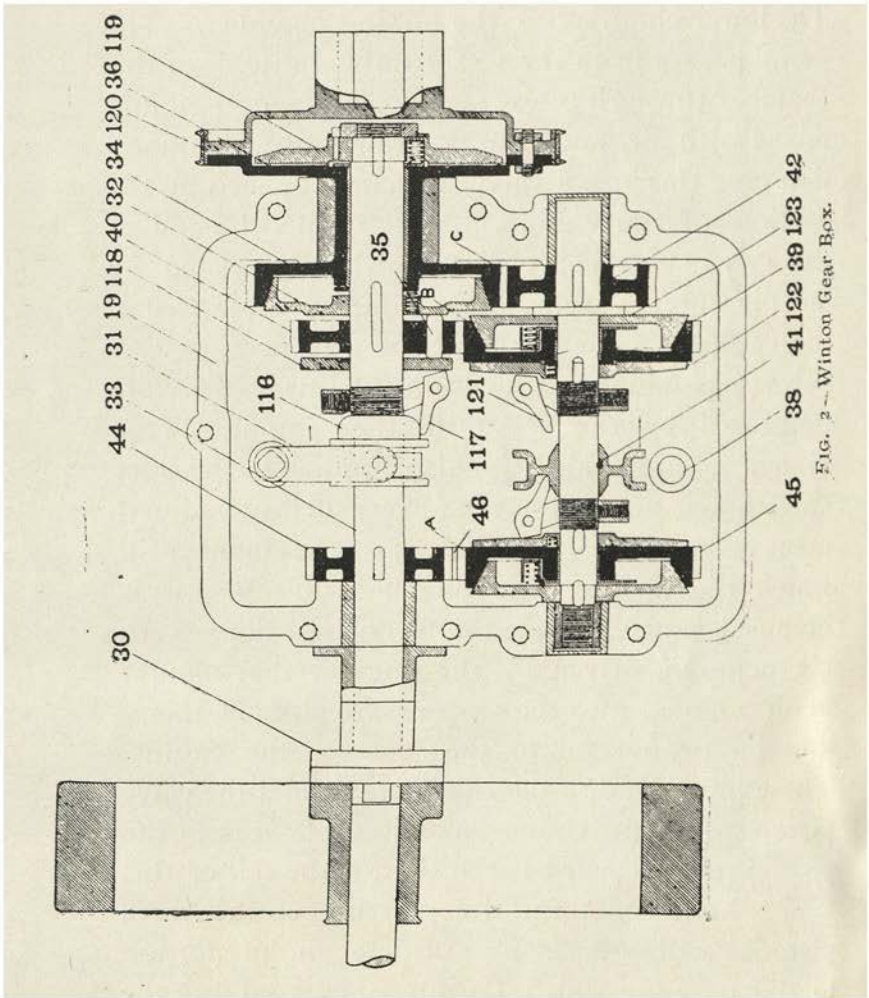


FIG. 2.—Winton Gear Box.

valves to their full extent, and so suck in a strong charge of gas.

The ignition is by gear driven magneto, and single non-vibrator coil. A spark advance lever is attached to the steering column, above the steering wheel.

The Winton method of changing speed is another interesting item in this unique car.

WINTON GEAR BOX.

19 Gear box, 30 Oldham coupling, 31 High speed gear shifting yoke, 32 High speed cone, 33 Main shaft, 34 High speed gear, 35 High speed clutch pin, 36 High speed gear, 38 Low and reverse speed shifting yoke, 39 Low speed gear, 40 Low speed pinion, 41 Low and reverse speed clutch ball, 42 Countershaft gear, 44 Reverse speed pinion, 45 Reverse speed gear, 46 Reverse speed idler, 116 High speed clutch ball, 117 High speed clutch dog, 118 High speed gear dog plate, 119 High speed friction disc, 120 Emergency brake drum and forward end of universal joint, 121 Low speed clutch dog, 122 Low speed clutch plate, 123 Low speed cone.

This gearing gives two forward speeds and a reverse speed. To obtain the high speed the shifting yoke (31) is moved backwards, forcing the clutch ball (116) against the ends of the dogs (117). This causes the dog plate (118) to bring the high speed cone (32) into driving contact with the pinion (34), which, it will be seen, forms one piece with the plate (36). This plate is securely bolted to the emergency brake drum (120), which forms part of the propeller shaft. The drive is therefore direct from the engine to the back axle. The low speed is obtained by moving the clutch ball (41), until it causes the low speed clutch dogs

to press on the low speed clutch plate (122), until it forces the low speed gear (39) into driving contact with the low speed cone (123). The drive is now taken from the engine through pinion 40 to pinion 39, thence through 42 to pinion 34, and so to the road wheels as before.

For the reverse, clutch ball 41 is moved forward, the pinion 45 is thus brought into driving contact with the reverse speed cone, and the drive is taken from the engine through 44, 46, 45, 42 and 34 to the road wheels.

It will be seen that the clutch, usually engaging in the fly-wheel, is unnecessary. The wear and tear occasioned by moving pinions into mesh is done away with, and the result of putting two gears into operation at the same time only results in the lower acting as a very powerful brake. The back axle mechanism requires no detailed description, as it varies little from the usual.

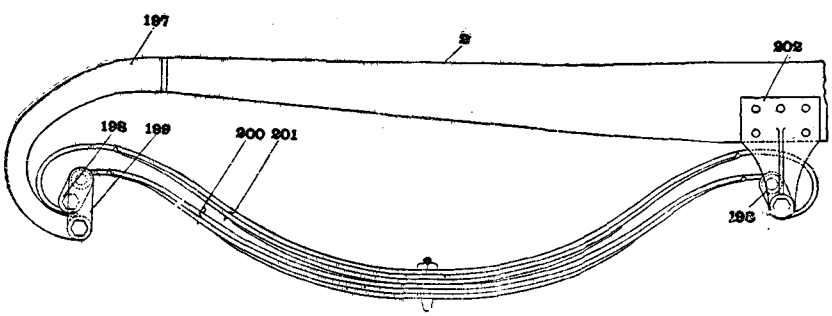


FIG. 3.

2 Side frame, 197 Spring horn, 198 Short spring shackle, 199 Long spring shackle, 200 Lower spring, 201 Upper spring, 202 Outside spring plate.

The brakes consist of two bands, on the driving wheel hubs, operated by a foot pedal and the emergency brake, previously referred to, actuated by the forward movement of the high speed lever.

This description would be incomplete without reference being made to the Winton patent carriage springs, Fig. 3.

The object attained by this double form of spring is to give the desirable proportion of resilience and strength, under both a light and a full load, only three leaves being engaged under the former conditions, and all six coming into operation, when required, by additional weight on the car, or by the nature of the road surface.

Prices complete with Side Entrance Body.

25 H.-P. 4-Cylinder Car ... £550
20 H.-P. 2-Cylinder ,, ... £400
16 H.-P. 4-Cylinder ,, ... £360

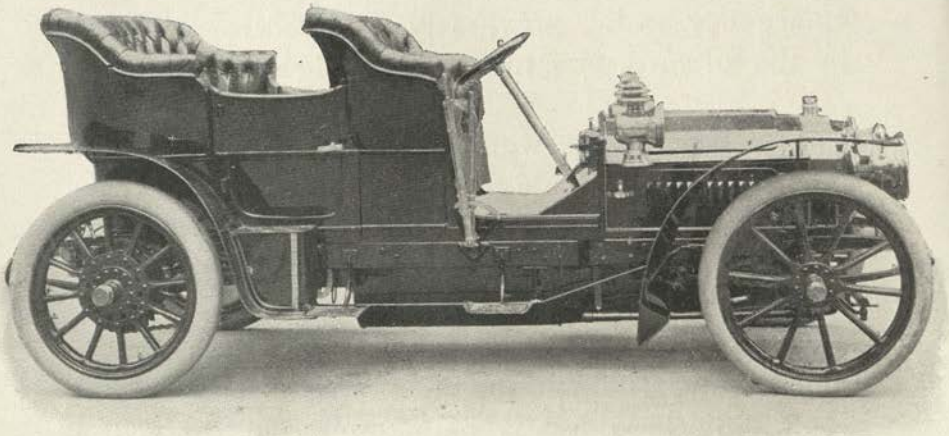
Address—

THE WINTON MOTOR CARRIAGE CO.,
CLEVELAND, OHIO, U.S.A.

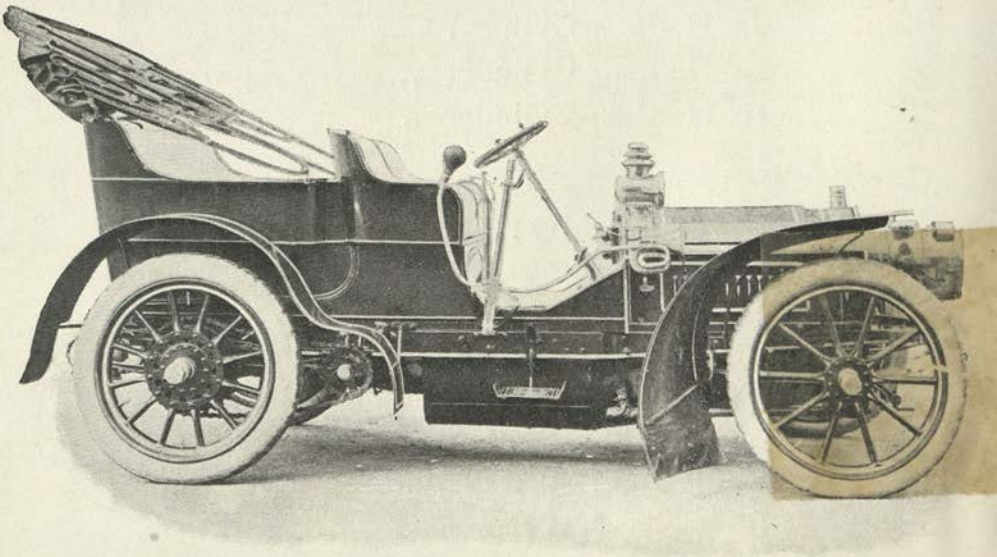
London Branch—

48, HOLBORN VIADUCT, E.C.

Telegrams: "WINTONIANS, LONDON."



22 H.-P. Crossley.



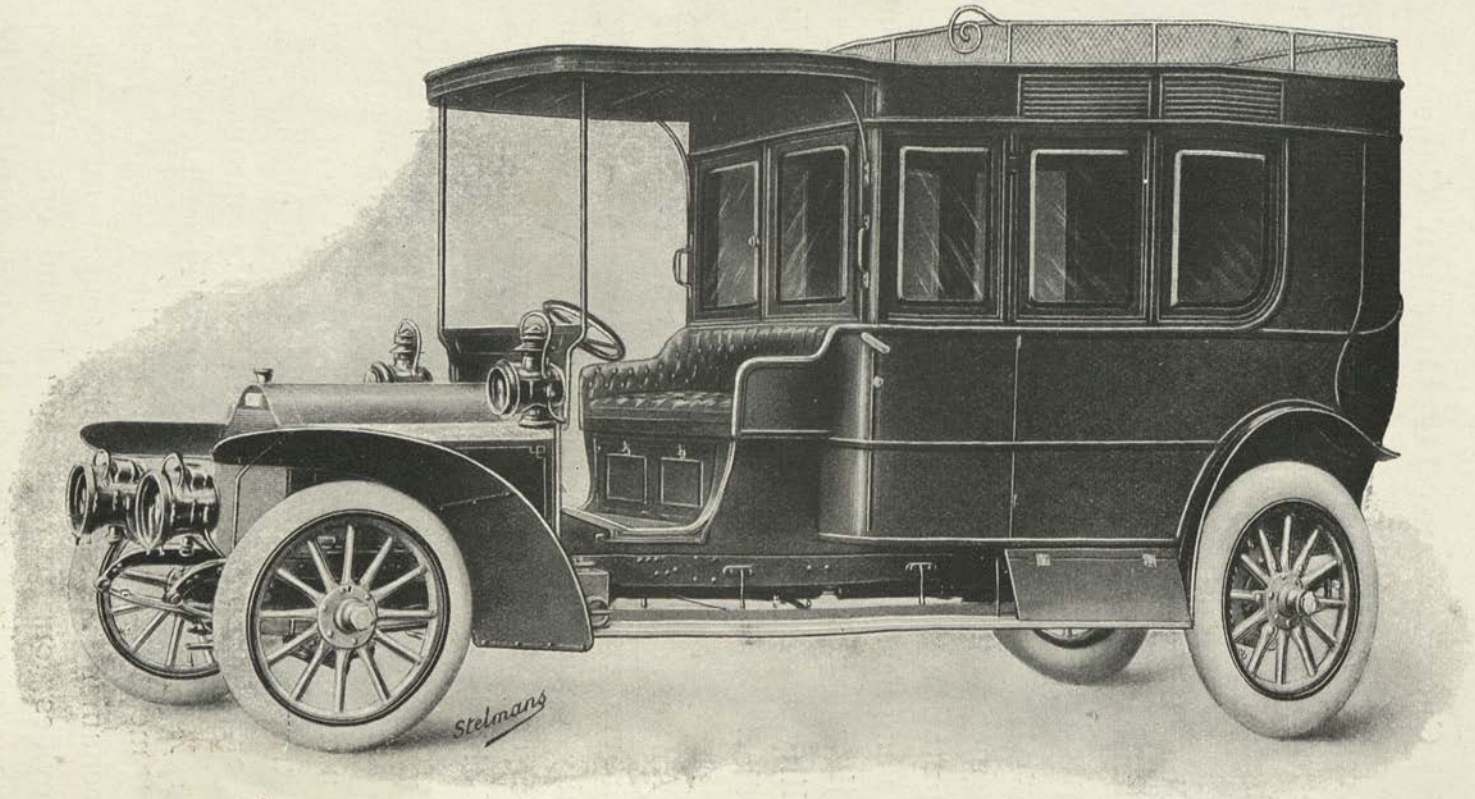
22—28 H.-P. Crossley.

Crossley and De Dietrich Cars.

I regret that, owing to want of space, I am unable to include in this volume detailed descriptions of these fine cars.

The Crossley engines (both 4-cylinder) are built in two sizes, rated 22 and 40 horse-power respectively. Messrs. Crossley Bros., of Manchester, are the makers of these magnificent engines, and have fully maintained the high reputation they gained as the manufacturers of gas engines. Every part of the engine is built in a jig, ensuring perfect accuracy and interchangeability, a great advantage in a car for use in India.

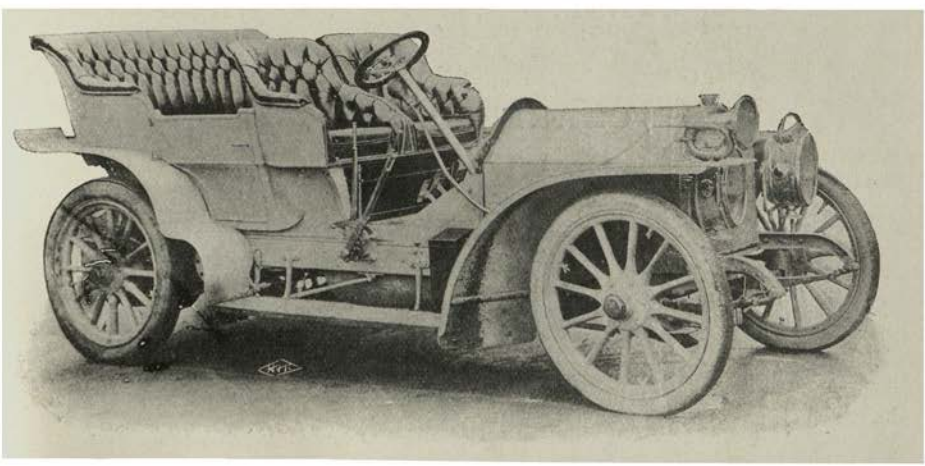
An exceedingly ingenious form of automatic carburetter is used. All valves are mechanically operated. The ignition is by low tension magneto, but provision is also made for the fitting of the high tension system. The cylinders are surrounded by large water jackets which provide an abundant supply of water around the combustion chamber, valves, and barrels. A gear driven centrifugal pump is employed for circulating the water. The cooling is effected by means of a honeycomb radiator and a fan. The clutch is of the metal-to-metal type. The change speed mechanism is exceptionally strongly made and provides four forward speeds and one reverse, giving a direct drive on the top speed. The



40-H.-P. De Dietrich.

engine parts and gears are well protected from dust and mud.

Mr. Charles Jarrott drove a 40 H.-P. Crossley from London to Monte Carlo in 37½ hours. The distance is close on 1,000 miles. Deducting the time occupied in crossing the channel and passing the car through the customs the actual running time was reduced to about 35 hours. For a car



24 H.-P. De Dietrich.

to come successfully through such a test (making every allowance for the fact that the driver was one of the most skilful in the world) clearly proves the excellence of both materials and workmanship. The prices, complete with side entrance bodies, are :—

22 H.-P. . . .	£850
40 H.-P. . . .	£950

The De Dietrich Cars, for which Messrs. Jarrott & Letts are the English agents, are well known in India. They are built in several models, the prices for complete cars being :—

12 H.-P. . . .	£ 580
16 H.-P. . . .	£ 750
24 H.-P. . . .	£ 930
40 H.-P. . . .	£1,150
60 H.-P. . . .	£1,350

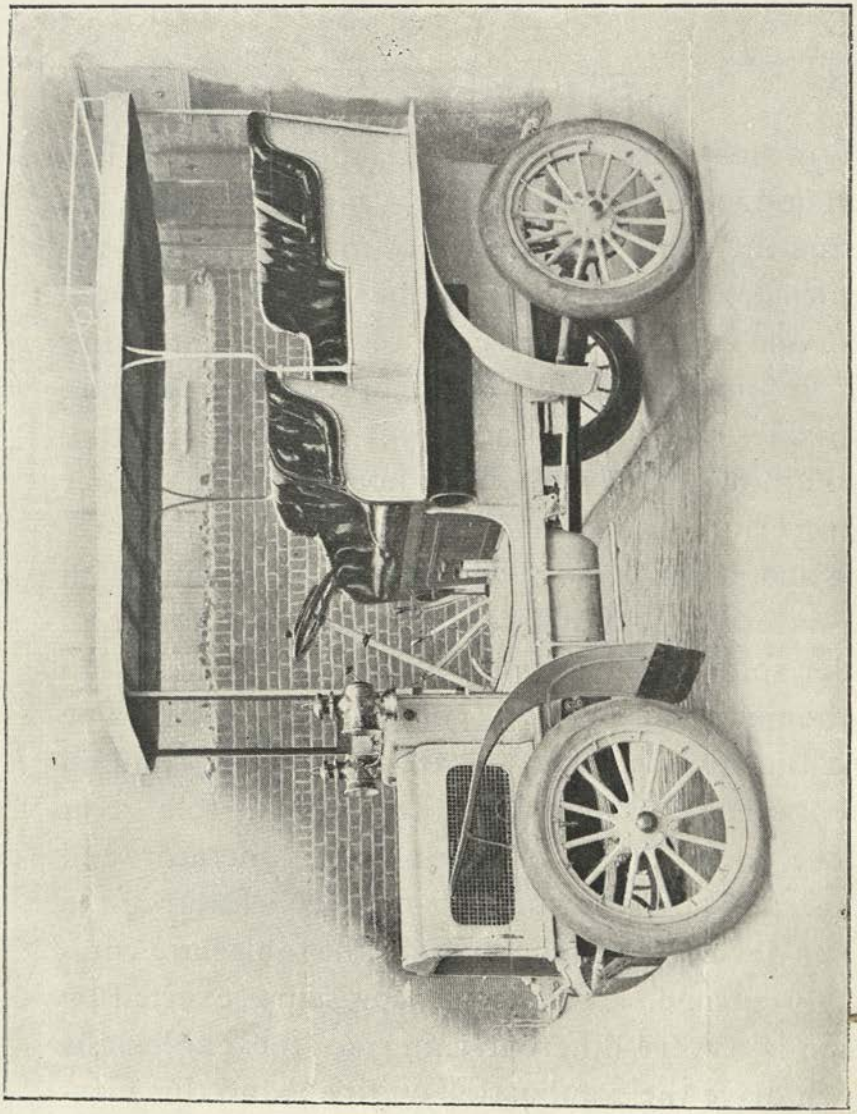
Address—

MESSRS. CHARLES JARROT & LETTS,
45, GREAT MARLBOROUGH STREET,
REGENT STREET,
LONDON, W.

CHAPTER IV.

STEAM CARS.

THE steam car, like its rival, the petrol car, has been much improved of late years. It is by no means the complicated piece of machinery that the advocates of the internal combustion engine would have one believe. A careful study of the following description of the White steam car will disabuse my readers of some of the erroneous ideas, so common among those who have not taken the trouble to ascertain the principles on which an up-to-date steam car is constructed. As compared with the internal combustion engine, the steamer is under some disadvantage, so far as the production of the necessary power is concerned. At the same time the absence of a delicate carburetter and an elaborate and vulnerable ignition system to a great extent counterbalance the steam generator and burner. When we come to the application of the power developed in the engine, the tables are completely turned. The steady pressure exerted by steam is a very different thing to the explosions which drive the combustion engine ; and this elasticity is the secret of the silent smooth running, combined with power on hills, which characterises the modern steam car. There is no necessity for change speed gearing, clutch, or fly-wheel.



The White Steam Car.

Any one wanting a thoroughly reliable, moderately priced steam car, should buy a "White" if—

(1) the car is required as a pleasure car and petrol is procurable;

(2) required for business purposes in a district (such as Calcutta) where petrol is cheap and easily obtainable.

If, on the other hand, petrol is not procurable or is too expensive to justify its use, then the Turner Miesse steam car, which burns paraffin as fuel, can be highly recommended.

The White Steam Car.

The White steam car will be familiar to all motorists, at least by name. The makers having produced a first class steam car, and fixed their prices as low as possible, are pushing their business with characteristic energy in all quarters of the globe. Although I would far rather see Englishmen buying their cars from English, and not foreign, firms, at the same time I am forced to admit that, in my opinion, any one in India who has decided to purchase a steam car cannot do better than invest in a "White," provided the necessary fuel can be obtained without difficulty and at a moderate price.

The two types of chassis, namely, 10 H.-P. and 15 H.-P., are fitted with a large variety of carriage bodies.

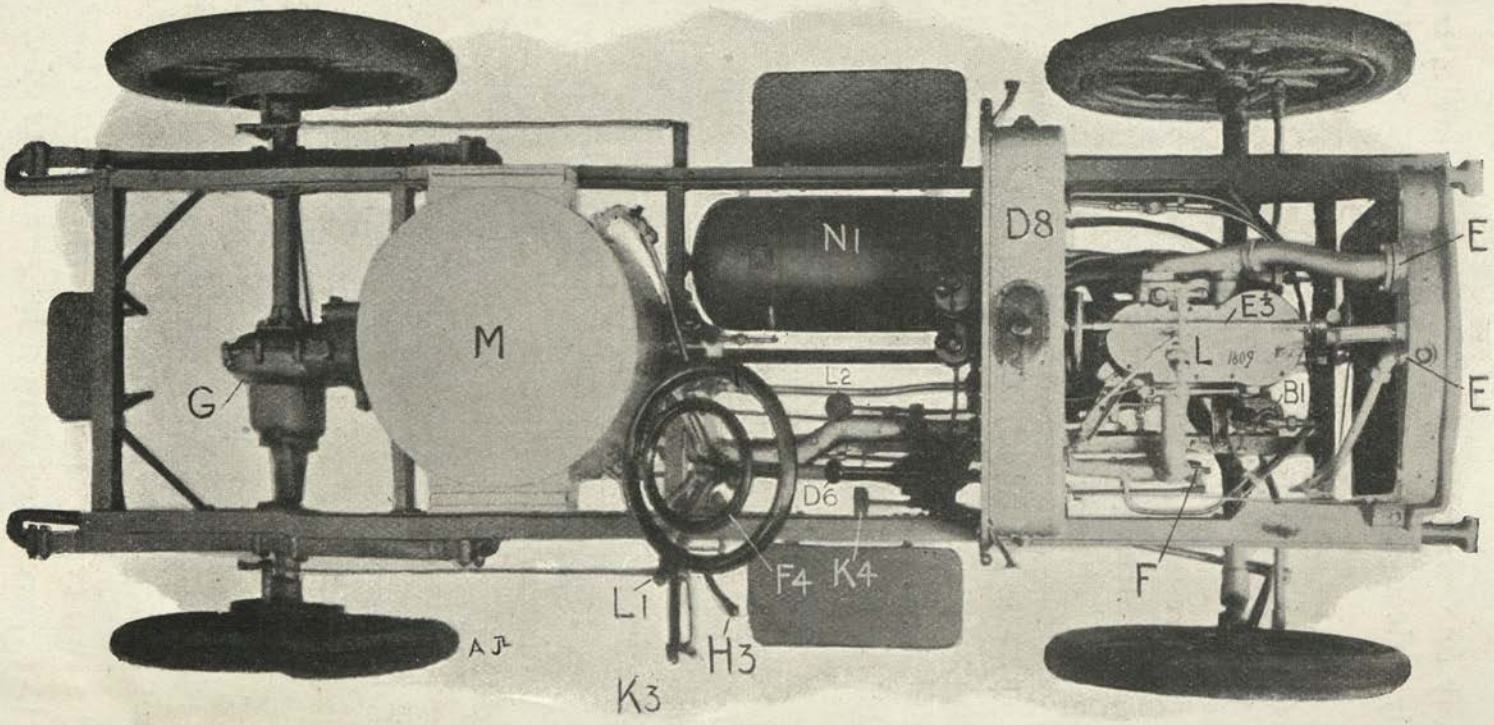


FIG. 1.

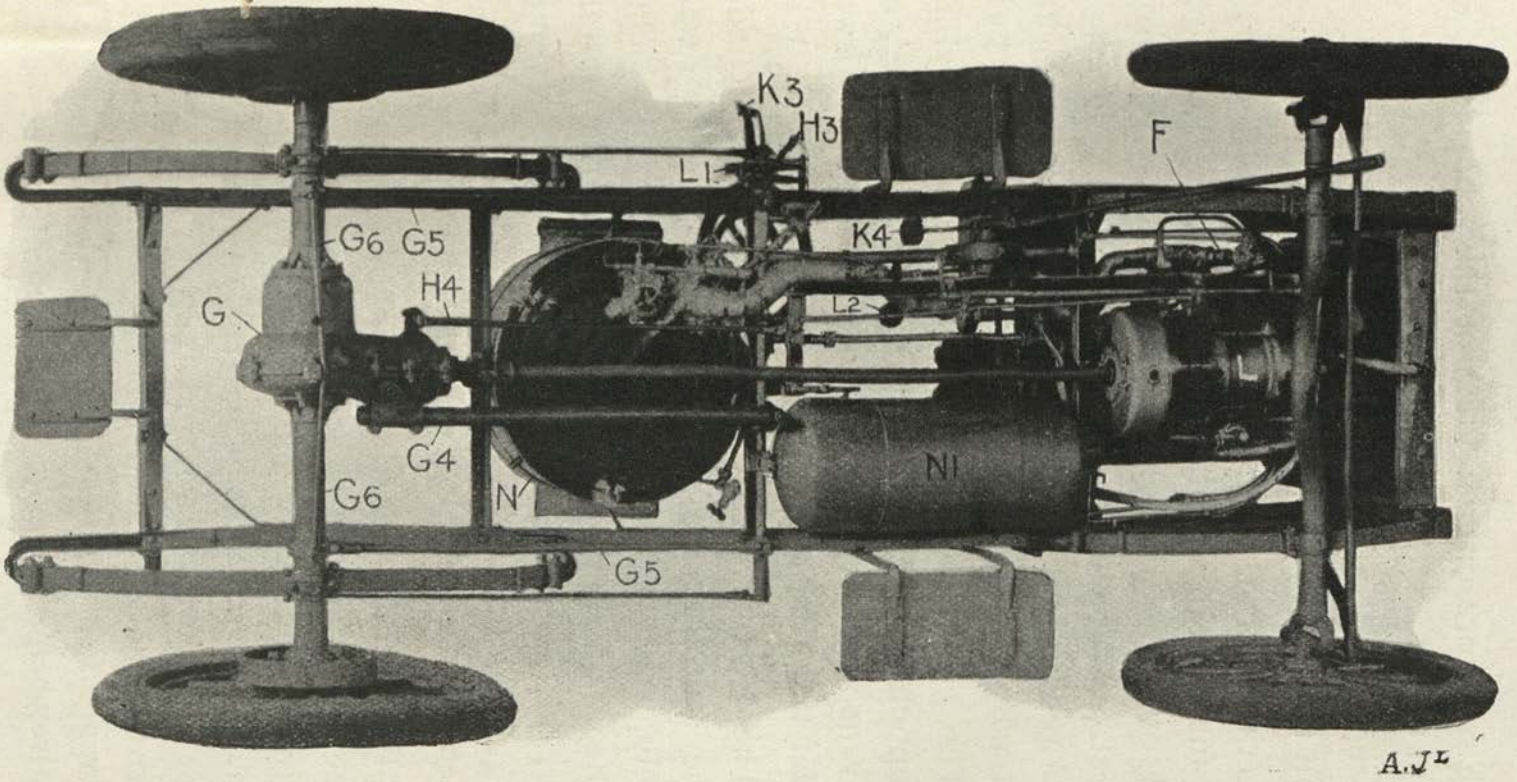


FIG. 2.

Fig. 1 presents a view of the chassis as seen from above.

Fig. 2 the same from below.

In these figures the lettering is as follows :—

L the engine, M the generator, N the burner, N_1 the fuel tank, G differential gear, E, E, exhaust and overflow pipes, F throttle valve, F_4 throttle wheel, G_4 axle stay, H_3 emergency lever, H_4 emergency lever rod, K_3 brake lever, D_6 hand water bye pass, D_8 water tank, L_2 simpling pedal.

The engine (Figs. 3, 4 and 5) is a 2-cylinder compound engine, fitted with D slide valves, and Stevenson link motion, and is placed forward under the bonnet.

The high pressure and low pressure cylinders have diameters of 3 inches and 5 inches respectively, the stroke in each case being $3\frac{1}{2}$ inches. When a slow strong pull is required, as at starting, the engine can be converted into a simple engine by pressing a foot pedal. Both cylinders then work under high pressure.

Fig. 3 shows the right side of the engine with the power air-pump and its connections Fig. 4 gives a back view showing the rocking lever for the simpling valves above, the power air-pump on the right, the water regulator on the left, and the driving shaft connection below. Fig. 5 shows the arrangement on the left side of the engine. The valves being governed by link motion, the engine can be readily reversed.

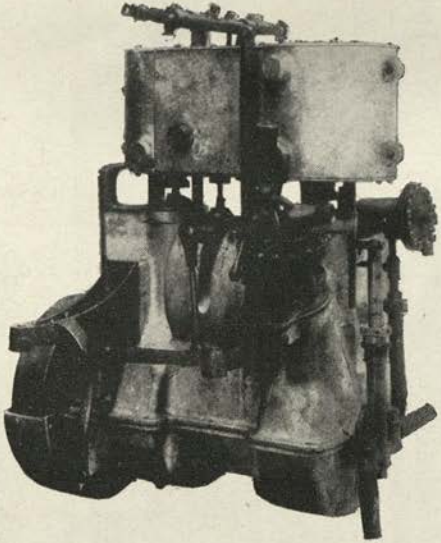


FIG. 3.

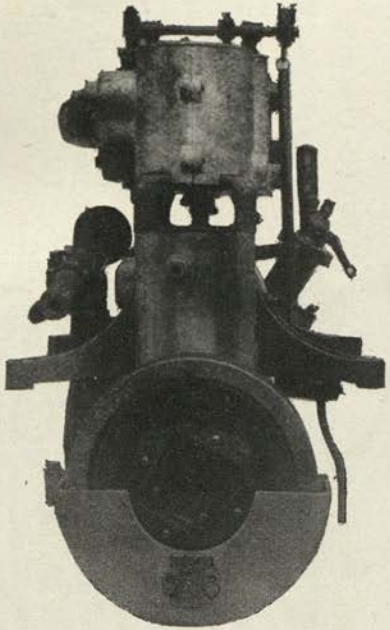


FIG. 4.

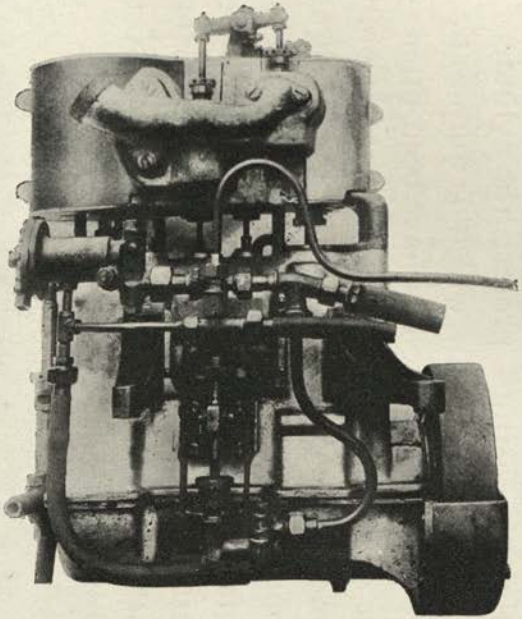


FIG. 5.

Aluminium casings protect the cylinders and cranks, the lubrication of which is automatic and effective. The latest models have been fitted with a change speed mechanism, which the Company call "emergency gear." As its name signifies, this second gearing is only required very occasionally, as for instance on a very steep hill. The introduction of this change speed mechanism has enabled the driver to run his engine free, a most valuable innovation.

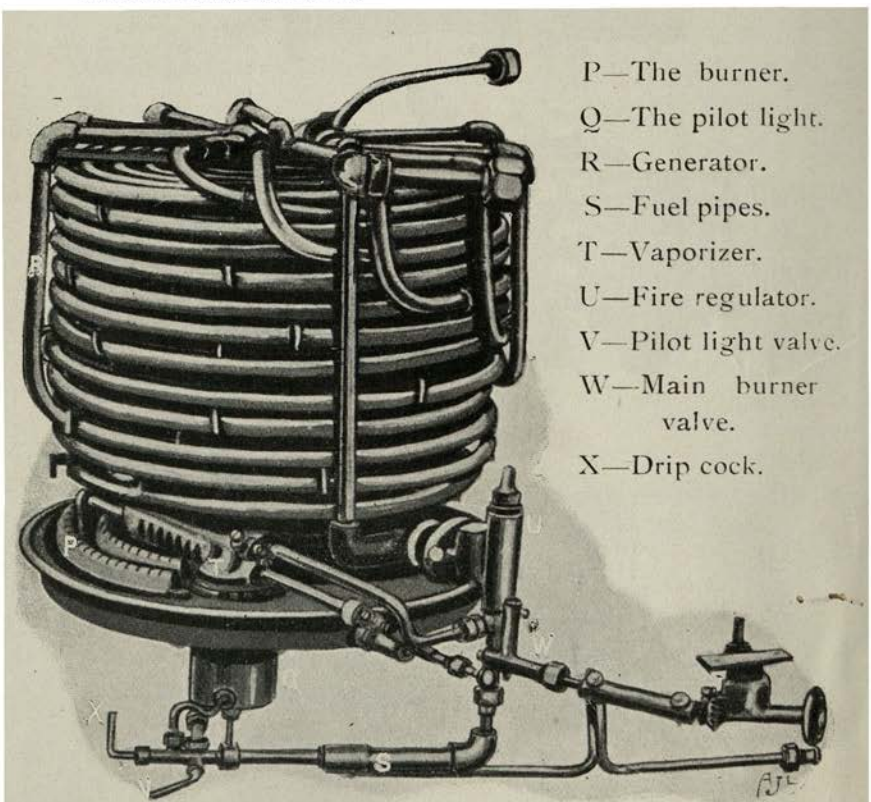


FIG. 6.

We now come to the most important part of the car, namely, the generator.

Fig. 6 shows the burner and generator with the asbestos jacket removed.

The pilot light Q is separate from the main burner P, and the fuel supply can be cut off from the one without effecting the other. The object of the pilot light is to heat up the vaporizer, this takes about three minutes. The main fuel supply being then turned on, the vapour issues from the perforations in the circular corrugations of the main burner. The generator, as will be seen, consists of eleven layers of coiled seamless tubing. The outer end of each layer is connected to the inner end of the layer below it, but these connections are all carried to the top of the generator in order to prevent the water from running down into the lower coils by gravity. The water enters the upper coils and is flashed into steam at some point in the lower coils. This point depends on the amount of steam being used. The water-supply is controlled automatically by the steam pressure. The burner is regulated automatically so as to provide the requisite amount of steam under all conditions. The generator cannot explode, and both it and the burner require no special care or attention. It will thus be seen that learning to drive, which is not a difficult matter, is about all the purchaser of a White steam car is called upon to do. The

car may be brought to a standstill owing to want of fuel or water, but as long as the lubricator on the dashboard is always kept supplied with a sufficiency of a suitable oil (and the oil feed pipes are kept clear), nothing more serious than this is likely to occur. The fuel is petrol of all grades of a specific gravity up to 750. The fuel and water tanks have a capacity capable of giving an approximate mileage of 100 miles for the 10 H.-P. and 150 miles for the 15 H.-P.

The prices are :—

10 H.P.

Chassis...	£375
,, with Standard Tonneau ...	£420
,, ,, Limousine body ...	£475
,, ,, Delivery Van body ...	£405

15 H.P.

Chassis...	£500
,, with Standard Tonneau ...	£550
,, ,, Limousine body ...	£600
,, ,, Landaulette body ...	£650
,, ,, Tonneau and Canopy...	£580

As per illustration.

Address :

WHITE STEAM CAR COY.,

35, 36 & 37, KING STREET, REGENT ST.,

LONDON, W.

Telegrams :

"YENISEAN, LONDON."

CHAPTER V.

TYRES.

THE perfect tyre has not yet been invented, but experience and keen competition have combined to produce a much more reliable article than was to be found on the wheels of motor cars a year or so ago.

The inventor of an unpuncturable tyre, which at the same time retained the many good points of the best "up to date" pneumatics, would (if he effectually protected his invention) soon find himself a very rich man. In the meantime good tyres can be purchased. Expense and delays on the road will not be very serious if a suitable size is selected, and the owner drives, or insists on his car being driven, in a reasonable manner. He must, however, also see that both inner tubes and outer covers receive the necessary care and attention, without which rapid deterioration is inevitable.

I have ventured, in this chapter, to repeat advice already given. My object in so doing is to impress upon car owners the importance of the proper treatment of tyres by quoting authorities, whose expert opinion cannot fail to carry very great weight.

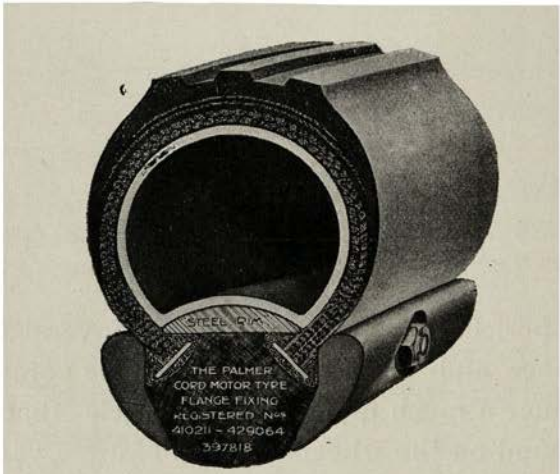


FIG. 1.

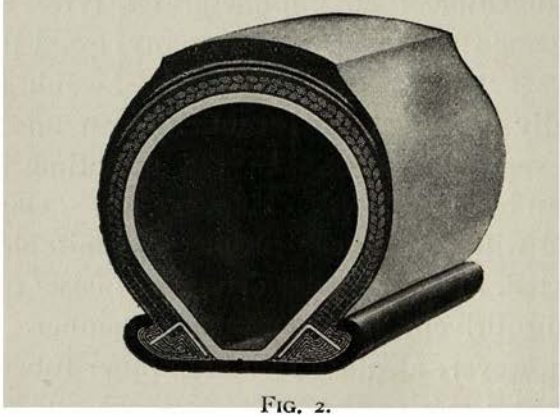


FIG. 2.

PALMER CORD TYRES.

These tyres possess qualities which render them particularly suitable for use in India. The canvas lining, which in other tyres is so liable to rot unless great care is taken to prevent water or damp getting at it, is in this tyre dispensed with. Instead a fabric of airless flattened cord is built up by an ingenious process of winding, in which the

cord from lying flat at the outer circumference of the tyre gradually turns on to its edge at the inner circumference. The flattened cord referred to above is produced by the combination of a considerable number of small cords, which consist of fine threads, each of which is impregnated with India-rubber solution under high pressure. Between the cord fabric and the outer rubber tread an endless belt of threads is embedded, as shewn in the illustrations, to prevent undue spreading of the tread.

Outside this belt is a thin strip of red rubber. When the tread wears down so as to expose the red rubber, the cover should be sent to be retreaded.

From the above very brief description it will be realized that the cost of production is very considerable, even if the cost of the exhaustive tests, to which materials and complete tyres are subjected, is left out of the reckoning. The Palmer Cord Tyres are made in two patterns, *viz.*—

Flange Fixing Type	... Fig. 1
Beaded Edge Type	... Fig. 2

Flange fixing is to be recommended, especially for heavy cars, as, even when deflated, the cover cannot become detached from the wheel without removing the side nuts. At the same time the removal of these nuts enables an inexperienced man to take out and replace an inner tube without difficulty. The objection, of course, is that the wheels have to be specially built, whereas the

beaded edge tyres fit standard rims of corresponding sizes.

The following table of pressures to which the different sized tyres should be inflated, under various loads, compiled by the Company, will be found useful :—

Minimum Pressures for Inflating Palmer Cord Motor Tyres.

Load per wheel.	Size of Tyre.				
Cwts.	3-in.	3½-in.	100-MM.	4-in.	5-in.
2	60 lbs.	53 lbs.	58 lbs.	58 lbs.	60 lbs
2½	63 lbs.	,,	,,	,,	,,
3	67 lbs.	,,	,,	,,	,,
3½	70 lbs.	,,	,,	,,	,,
4	73 lbs.	,,	,,	,,	,,
4½	77 lbs.	57 lbs.	,,	,,	,,
5	—	60 lbs.	,,	,,	,,
6	—	67 lbs.	64 lbs.	64 lbs.	,,
7	—	75 lbs.	71 lbs.	71 lbs.	65 lbs.
8	—	82 lbs.	77 lbs.	77 lbs.	70 lbs.
9	—	—	84 lbs	84 lbs.	75 lbs.
10	—	—	90 lbs.	90 lbs.	80 lbs.
11	—	—	—	—	85 lbs.
12	—	—	—	—	90 lbs.
13	—	—	—	—	95 lbs.
14	—	—	—	—	100 lbs.
15	—	—	—	—	105 lbs.

ENGLISH PRICES.

Flange Fixing Pattern (Plain Tread).

Sizes in inches.	Nominal Millimetres.	Per Tyre, plain tread, complete, minus Rim, Flanges, &c.	Cover, Plain Tread.	Special Moulded Jointless Tubes.
30 by 3½	760 by 90	£12 6 0	£9 18 0	£2 8 0
30 by 4	760 by 105	15 2 6	12 10 0	2 12 0
32 by 4	810 by 105	16 3 0	13 6 0	2 17 0
34 by 4	870 by 105	17 11 6	14 9 0	3 2 6
36 by 4	910 by 105	18 12 0	15 5 0	3 7 0
34 by 5	870 by 125	18 14 6	15 11 0	3 3 6
36 by 5	920 by 125	19 15 0	16 7 6	3 7 6

Ribbed Tread Tyres (non-slipping) 20- per cover extra.

BEADED-EDGE TYRES.

(Plain Tread).

Nominal Sizes in ins.	Nominal Millimet es.	Per Tyre, plain tread complete, minus Rim.	Cover. Plain Tread.	Special Moulded Jointless Tube.	Rim.
28 by 3	700 by 75	£8 2 6	£6 14 0	£1 8 6	£0 5 6
30 by 3	750 by 75	8 12 0	7 2 0	1 10 0	0 6 0
32 by 3	800 by 75	9 6 6	7 15 6	1 11 0	0 6 6
28 by 3½	700 by 90	11 12 6	9 7 0	2 5 6	0 6 9
30 by 3½	760 by 90	12 6 0	9 18 0	2 8 0	0 7 0
32 by 3½	810 by 90	13 0 0	10 9 0	2 11 0	0 7 6
34 by 3½	870 by 90	14 6 0	11 11 0	2 15 0	0 8 0
36 by 3½	910 by 90	14 10 6	12 2 0	2 17 6	0 8 9
*Special size to fit 870 by 90 Rims.	870 by 100	17 11 6	14 9 0	3 2 6	0 8 0
*32 by 4	815 by 105	16 3 0	13 6 0	2 17 0	0 11 0
34 by 4	875 by 105	17 11 6	14 9 0	3 2 6	0 11 6
36 by 4	915 by 105	18 12 0	15 5 0	3 7 0	0 12 0
32 by 5	820 by 120	17 14 0	14 16 0	2 18 0	0 11 6
34 by 5	850 by 120	18 14 6	15 11 0	3 3 6	0 12 6
*35 by 5	880 by 120	19 5 0	15 19 0	3 6 0	0 13 0
36 by 5	920 by 120	19 15 0	16 7 6	3 7 6	0 13 6

Ribbed Tread Tyres (non-slipping), 20- per cover extra.
* These sizes are only supplied Ribbed Tread.

The approximate cost of packing for one set of tyres is about 10 shillings.

Freight from 16*s.* to 20*s.* according to size of case. The time of transit to Bombay about 3 weeks.

Address—

THE PALMER TYRE, LD.,
119, 121, 123, SHAFTESBURY AVENUE,
LONDON, W.C.

AGENTS IN INDIA—

MESSRS. C. R. MONTGOMERY & CO.,
FAIRLEY PLACE, CALCUTTA;
MESSRS. FLEMING & CO.,
BOMBAY.

The Sirdar Rubber Company's Tyres.

Mr. MacLulish, Managing Director of the firm, writes as follows with regard to--

I.—SIRDAR RUBBER TYRES.

"Bicycles require light pneumatic tyres, because they are propelled by the rider who does not want to carry an ounce more than he can help. In 1900 the two great pneumatic tyre inventions were patented by Welch & Bartlett, both of which patents expired last year. They were invented primarily for bicycles which have no springs, and the tyre was not intended to be inflated very hard or required to carry a heavy load, but was meant to take the place of springs and tyres; and when you compare the weight of the two alternatives, there is little wonder that no one now rides a heavy solid tyred spring framed bicycle. With a motor car it is different. A car built to carry four people is geared to go a certain speed with the engine running at a certain number of revolutions, whether the ignition is advanced or retarded, and if, for instance, it is geared to do 30 miles an hour with four people up, it will go no faster with only one person up. But if a cyclist can travel 20 miles an hour with a light machine, he could not travel the same pace with extra weight, for it is manual labour and not a mechanical calculation as so many people seem to forget. On bicycles the pneumatic tyre does the work of the springs and the solid rubber tyre better

than it possibly can on a motor car, for the simple reason that it is pumped to such a low pressure on a bicycle that it absorbs almost every obstruction; but the motor tyre must of necessity—if it is to last even a thousand miles—be pumped hard, so as to carry the great weight of the car, and the difference between cycle tyres and motor tyres is so great that one would not think of driving in a car with pneumatic tyres without springs, yet no bicycle has springs. And as Sir Alfred Harmsworth says in the third edition of the Badminton Library: 'Am inclined to think that the *pneumatic tyre craze* has been altogether overdone by motor car owners. They are very liable to puncture in hot weather, more prone to cause side-slip, and in several ways a luxury that has to be paid for. I advance these points to prevent a purchaser from committing himself to pneumatic tyres, *because other people use them.*' I am afraid a great many motorists are like sheep that have gone astray, and do a lot of things simply because other people do them; it is not difficult to realise why the average motorist commits himself to pneumatic tyres without considering all sides of the question, for quite recently the majority of his motoring friends enjoyed the sport of racing along country roads which were not made for such purposes and are unsuitable for such high speeds. They practically used racing cars with touring bodies, but on the touring car of to-day a pneumatic tyre is not a necessity

but a craze. Any one, who has a properly sprung car, travelling not more than 20 to 30 miles an hour, need have no fear of expense or trouble if he adopts a good solid rubber tyre; and it makes motoring practical and even economical; but at the excessive speeds which some people still travel at, that is from 30 to 60 miles an hour on the modern racing touring car, if I may call it so, a pneumatic tyre is a necessity, because of those speeds, the car is continually jumping for a considerable distance off the road, and the elasticity of rubber alone is not quick enough to receive such a shock, for when the wheel strikes the road at such speeds, compressed air or compressed gas are, as far as I know, the only things that are quick enough in meeting and springing away from obstructions caused by a rough road without transmitting such quick and severe shocks to the occupants of the car at such high speeds.

"Some people are, of course, more fortunate than others with pneumatic tyres, but there is always that unhappy feeling that it is possible to have your tyres punctured at any moment which some of my fellow-members of the Automobile Club here have described as walking with bare feet over tin-tacks or broken bottles; carriage users would not put up with the annoyance of them, but expense and annoyance seems to be the pleasure of the wealthy motorists, and so long as such people indulge in motoring at excessively high speeds, they do not object to the expense and trouble for

the sake of the small extra comfort (while travelling at excessive speeds) as compared with that derived from a perfectly constructed solid rubber tyre in conjunction with good springs which are now fitted to every first class motor car. Even up to 25 miles an hour, there is practically no difference between a properly constructed solid rubber tyre and a pneumatic tyre as regards vibration; and the advantages of the solid, from a reliable and economical point of view, are enormous. They also throw less dust, which is a matter of great consideration to the general public and carriage users in particular, and they are less inclined to side-slip.

"I think any one who plays billiards will appreciate how simple it is to utilise the otherwise destructive side forces by a scientifically constructed rim, in conjunction with a properly constructed solid rubber tyre as shown in Fig. 1; the otherwise destructive side-strains are utilised by retaining them within the special angular channel of the Royal Sirdar Tyre which causes the tyre to wedge across the base and hold on with additional security in proportion to any upward or side-strain put upon it at the place in contact with the ground. This principle allows the whole of the rubber above and below the rim to act as a cushion without interruption from the edges of the rim, and the angles are so arranged that in conjunction with the rubber tyre the side-forces cannot roll the rubber in the rim, but are

tilted across at the desired angle which causes the rubber to wedge in the rim, giving the much desired additional security.

2.—SIRDAR AIR TUBES.

"Mons. Michelin has declared that the cause of 51% of the injuries to air chambers is the nipping of the inner tube, and in the books of instruction issued by various other pneumatic tyre makers, I find they pay great attention to this and show numerous sketches and methods of trying to avoid nipping in fitting, notwithstanding which this great evil still exists in that large proportion.

"I have been deeply interested in the tyre question from every point of view, in fact I manufacture both pneumatic and solid, and am showing you here a drawing, Fig. 2, of a perfectly simple remedy—an invention of my own—to do away with what M. Michelin states is more than 50% of the pneumatic tyre troubles, *i.e.*, the nipping of the inner tube. Fig. 3 is the ordinary

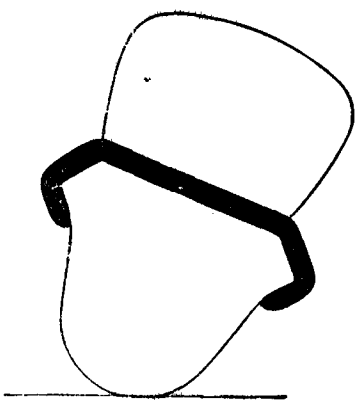


FIG. 1.

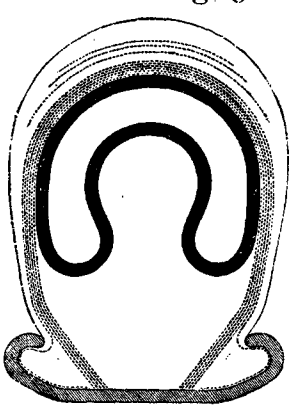


FIG. 2.

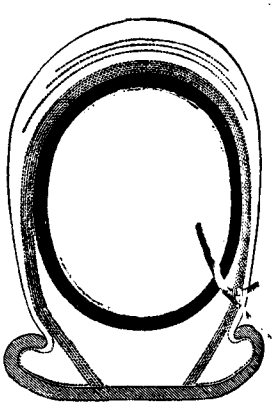


FIG. 3.

pneumatic tyre tube inside the cover; you are, of course, aware that it is made smaller than the cover to try, as far as possible, to obviate nipping the tube by the edges of the cover when fitting it; but this does not prevent the evil as we all know, and it has great disadvantages, in that the rubber of the tube when inflated is in tension, which causes it to be easily pierced even by a blunt instrument. The difference between piercing compressed rubber and stretched rubber can be seen at a glance by pressing a pin against a sheet that is stretched and the same sheet compressed. To get the tube, as shown in Fig. 2, compressed both laterally and longitudinally and so make it extra tough and puncture-resisting, I make it larger in diameter than the inside of the cover and also larger in circumference, and vulcanize it in U shape, so that when inflated it is under compression in every direction, and when it is deflated it springs up into the crown of the cover, consequently in fitting a cover it is up out of the way and impossible to nip. The same evil exists in a smaller degree in bicycle tyres, and of course this tube is fitted with equal success to them; the tube *must not be* inflated when fitting.

With regard to the care of tyres, they should be kept in a temperature of about 60 deg. in a dark place, and, if possible, out of a draught and should never be exposed to the rays of the sun before they are used (the sun has not so much effect upon tyres after use); if they are, they will lose their elasticity and become brittle, and

small cracks will appear which will gradually grow larger. Immediately after use, pneumatic tyres should be cleaned from wet and mud, and cuts in the covers should be closed so as to prevent water getting in and rotting the canvas, which is the cause of many burst covers. Oil or grease should not be allowed to get on the rubber, as it destroys the nature of it.

The pump for inflating tyres should always have a pressure gauge upon it, and the tyres should be pumped sufficiently hard if they are to last any reasonable length of time; on bicycles about 30 lbs. to the square inch; on voiturettes about 50 lbs. to the square inch; on light cars about 75 lbs. to the square inch (this is harder than the best solid tyre), and on heavy cars about 100 lbs. to the square inch; and racing motor car tyres are frequently pumped to about 120 lbs. to the square inch, that is, speaking generally. It is of course an advantage on a motor car with pneumatic tyres fitted to have all the wheels of equal size, as it means carrying fewer spare covers and tubes, all the tyres being interchangeable, and the larger the diameter of the wheel the less wear and tear there is on the tyres.

Of course I do not suggest that pneumatic tyres are not more comfortable if they are inflated too soft as most people use them, but then the want of proper inflation causes the tyre to flatten on the road and gives at least 50 per cent. wider running surface and an equally greater risk of puncture with a severe hinging or splitting action

in the walls or sides of the cover, so that what one gains in comfort with an exceptionally soft partially inflated pneumatic tyre, one can hardly afford to lose in the discomfort of time and money wasted in repairs and renewals, to say nothing of the anxiety of tyre troubles."

Prices for Tyring and Rubbering Wooden Wheels with Large Royal Sirdar-Buffer Tyres.

Pairs not exceeding Diameter in Wood. ft. in.	1 in. £ s. d.	1¼ in. £ s. d.	1⅜ in. £ s. d.	1½ in. £ s. d.	1¾ in. £ s. d.	2 in. £ s. d.	2½ in. £ s. d.	3 in. £ s. d.	5 in. £ s. d.	ft. in.
2 6	3 0 0	4 12 0	4 19 0	6 2 0	7 3 0	9 2 0	14 15 6	22 1 6	33 2 0	2 6
2 8	3 3 0	4 19 0	5 7 0	6 14 0	7 16 0	10 1 0	15 16 0	23 2 6	34 11 0	2 8
2 10	3 6 0	5 4 0	5 12 0	7 0 0	8 2 0	10 7 0	16 15 0	25 1 6	37 12 0	2 10
3 0	3 8 0	5 8 0	5 18 0	7 5 0	8 10 0	10 19 0	17 9 0	26 1 6	9 2 6	3 0
3 2	3 11 0	5 13 0	6 3 0	7 11 0	8 16 0	11 11 0	18 5 0	27 6 6	40 19 6	3 2
3 4	3 13 0	5 19 0	6 6 0	7 19 0	9 6 0	12 2 0	19 6 6	28 17 6	43 6 6	3 4
3 6	3 15 0	6 3 0	6 12 0	8 5 0	9 13 0	12 15 0	20 15 0	31 0 6	46 11 0	3 6
3 8	3 17 0	6 9 0	6 17 0	8 11 0	10 0 0	13 5 0	21 12 0	32 5 6	48 8 6	3 8
3 10	4 0 0	6 12 0	7 3 0	8 18 0	10 8 0	13 13 0	22 7 0	33 7 6	50 1 6	3 10
4 0	4 4 0	6 16 0	7 9 0	9 2 0	10 19 0	14 8 0	23 5 0	34 15 6	52 3 0	4 0
4 2	4 5 0	7 1 0	7 17 0	9 14 0	11 7 0	15 0 0	24 12 6	36 15 6	55 3 0	4 2
4 4	4 8 0	7 9 0	8 1 0	9 19 0	11 15 0	15 9 0	25 10 0	38 3 0	57 5 0	4 4
4 6	4 10 0	7 13 0	8 6 0	10 5 0	12 6 0	16 3 0	26 8 0	39 9 6	59 4 0	4 6
4 8	4 14 0	7 17 0	8 11 0	10 11 0	12 9 0	16 16 0	27 0 0	40 8 0	60 12 0	4 8
4 10	4 18 0	8 3 0	8 15 0	10 17 0	12 17 0	17 6 0	27 13 7	41 10 0	62 5 0	4 10

Prices for Fitting New Royal Sirdar-Buffer Tyres to Existing Rims only.

Pairs not exceeding Diameter in Wood. ft. in	1 in. £ s. d.	1¼ in. £ s. d.	1⅜ in. £ s. d.	1½ in. £ s. d.	1¾ in. £ s. d.	2 in. £ s. d.	2½ in £ s. d.	3 in. £ s. d.	5 in. £ s. d	ft. in.
2 6	2 10 0	3 10 6	3 17 0	5 1 3	6 1 1	7 12 6	11 17 4	18 17 0	28 5 6	2 6
2 8	2 15 0	3 16 9	4 6 3	5 12 6	6 16 1	8 11 0	12 18 0	20 8 6	30 12 6	2 8
2 10	2 16 6	4 2 6	4 11 1	5 15 3	6 19 8	8 18 1	13 17 1	21 10 0	32 15 0	2 10
3 0	3 0 6	4 7 0	4 16 6	6 4 1	7 8 3	9 10 3	14 7 7	22 17 6	34 6 0	3 0
3 2	3 3 0	4 12 3	5 2 0	6 9 0	7 11 1	10 1 9	15 9 3	24 3 6	36 5 0	3 2
3 4	3 6 0	4 17 9	5 4 9	6 17 7	8 3 11	10 13 9	16 8 6	25 11 0	38 11 0	3 4
3 6	3 8 6	5 2 0	5 9 9	7 3 3	8 10 3	11 7 3	17 16 3	27 16 6	41 15 0	3 6
3 8	3 11 6	5 6 9	5 15 6	7 8 10	8 18 10	11 16 7	18 13 6	28 10 0	42 15 0	3 8
3 10	3 14 0	5 10 6	6 1 2	7 11 9	9 5 3	12 4 6	19 9 3	30 4 0	45 6 0	3 10
4 0	3 17 0	5 14 9	6 7 6	7 19 9	9 17 3	12 18 9	20 7 0	31 14 0	47 11 0	4 0
4 2	3 19 6	5 19 0	6 15 4	8 11 9	10 5 10	13 10 9	21 13 6	33 11 6	50 7 0	4 2
4 4	4 2 6	6 6 9	6 19 6	8 16 7	10 13 0	14 0 11	22 11 1	34 15 6	52 3 0	4 4
4 6	4 5 0	6 8 6	7 4 0	9 3 1	11 4 4	14 14 0	23 6 1	35 3 0	52 15 0	4 6
4 8	4 8 0	6 15 6	7 8 10	9 9 6	11 17 3	15 4 4	24 4 9	35 14 0	53 11 0	4 8
4 10	4 10 6	7 1 0	7 13 2	9 16 0	12 4 4	15 16 11	24 16 6	36 1 0	55 4 0	4 10

The Company recommend the 2½" section tyre for cars up to 15 cwts.
" " " 3 " " " " 25 "
" " " 5 " " " " 35 "

The remarks on the preceding pages are of special value coming, as they do, from the Managing Director of a firm which manufactures both "solids" and pneumatics.

New wheels built to specification of the finest selected cleft oak with half hickory rims would cost £5-0-0 per pair, and tyring them with the $2\frac{1}{2}$" section, provided they do not exceed 35 inches high over the tyres, would cost £14-15-6 per pair, making the total cost £19-15-6 per pair, and the large 3" high-speed section would cost £27-1-6 per pair of wheels complete, provided the total height did not exceed 35 inches; and the 5" high-speed section £38-2-0 per pair.

The Company have agreed to allow a discount of 20% for cash, on Indian orders, in the above three cases, This, it is anticipated, will cover freight and packing charges.

The following particulars should be given when ordering spare wheels. The make and date of the car, the horse-power, number, heights of the wheels over the tyres, the diameter across the flanges of the hub, the width of the spokes between the flanges, number of plain and bulb spokes in the wheel, the distance from centre to centre of bolt holes in opposite bulb spokes, the thickness of the bulb on the bulb spokes, and the amount of dish there is in the wheel, placing a straight edge across the front of the wood felloe. The Company can then build a pair of spare wheels which will fit the present hubs and sprocket wheels and send them out tyred complete so that

the sprocket wheels and hubs can be taken off the old wheels by any local agent or Coach-builder and fitted to the new wheels, and they can be painted when they arrive.

PRICES OF ROYAL SIRDAR NON-NIPPING AIR TUBES AND HEAVY MOTOR COVERS.

Size. Approximate Inches.	Millimetres.	Tubes. £ s. d.	Heavy Covers. £ s. d.
2½ × 26	65 × 650	0 19 0	3 7 11
28	700	0 19 10	3 11 11
30	750	1 0 8	3 15 10
32	800	1 1 5	3 19 1
3 × 28	80 × 700	0 19 10	3 14 11
30	750	1 0 8	4 0 4
32	800	1 1 10	4 5 4
3½ × 28	85 × 700	1 3 10	3 19 8
30	750	1 5 5	4 6 0
32	800	1 6 7	4 12 4
3½ × 28	90 × 700	1 13 9	5 5 3
30	760	1 15 9	5 10 10
32	810	1 17 4	5 16 4
33	840	1 19 8	6 1 1
34	870	2 1 3	6 5 1
36	910	2 2 10	6 12 2
40	1010	2 6 0	7 6 6
4 × 30	100 × 760	1 19 3	6 10 10
32	810	2 1 0	7 3 10
34	870	2 4 6	7 14 0
36	920	2 6 0	8 3 0
4¼ × 32	105 × 815	2 2 10	7 14 6
34	875	2 5 3	8 6 4
36	915	2 7 8	8 14 4
5 × 34	120 × 850	2 7 8	8 8 9
35	880	2 9 3	8 19 10
36	920	2 10 10	9 5 6
40	1020	2 16 4	10 11 7

Address—

THE SIRDAR RUBBER COMPANY,
SHIRLAND ROAD, PADDINGTON,
LONDON, W.

Telegrams—

"SIRDAR," LONDON.

The Continental Motor Tyre.

In reply to my enquiries regarding their tyres the Continental Tyre and Rubber Company forwarded to me a copy of their "1905 Handbook for Automobilists in Great Britain and Ireland," and at the same time wrote a most courteous letter inviting me to make use of any of the information contained in the handbook. The work consists of over 1,200 pages of small print. After eliminating the very complete "Automobilist's Gazetteer for Great Britain and Ireland" and other information of purely local interest some hundreds of pages remain, all or any of which might be reproduced with advantage to my readers. Thirty-nine pages are devoted to pneumatic tyre defects and how to treat them. The subject is dealt with under the following headings :—

1. Tyre accidents caused by the roughness of the roads.
2. Tyre accidents due to the design of the car.
3. Tyre accidents due to the carelessness of the driver.
4. Destruction of tyres by oil and acids.
5. Cutting the edges, causes of—
6. Necessity for using sufficiently heavy tyres.
7. Rotting inside through water getting into the tyre.
8. Influence of light and temperature.
9. Accidents to the air tube alone.
10. Putting on and taking off tyres.

11. Best way to learn above.

12. How to keep spare air tubes.

Each point is clearly described and well illustrated, the whole forming one of the best chapters ever written on this most interesting subject. A series of 23 reproductions from photographs graphically illustrates the best method of detaching and replacing a pneumatic tyre. I will content myself with giving one of the above paras (No. 10) in full, and short extracts only from such of the others as are generally overlooked: "Unfortunately our well-meant advice not to use the outer cover after the canvas has become visible is often not followed, and the cover only sent to us after wearing out the canvas down to the last shred, resulting in the bursting of the inner tube. In this way not only is the inner tube damaged but the outer cover is often damaged to such an extent as to make it impossible to repair it.

"Do not apply the brake suddenly. Do it gradually.

"Our repair department receives nearly every day covers showing signs of wear on the sides, so that the canvas layers are exposed. What is the cause? It may be due:—

1. To the driving against kerbstones.

2. To the driving with tyres deflated.

"The edges (of tyres) can be cut—

(*k*) by an excessive load on the tyres,

(*l*) by unsuitable rims,

(*m*) rusty and bent rims,

(*n*) driving with slack or deflated tyres,

(*o*) rounding curves too sharply,

(*p*) loose or unsuitable studs.

"The chief cause of water getting into the tyre and causing its canvas backing to rot is slackness of the tyre and insufficiently tightened nuts.

"Though perfectly waterproof, rubber is easily affected by oil and acids, and, if exposed to their action for any length of time, soon becomes totally destroyed.

"10. PUTTING ON A COMPLETE TYRE.

(*t*) *Inner Tube and Outer Cover.*

"In this paragraph we will give a few hints as to the putting on of motor tyres. To do this work properly one needs first a proper kind of lever, and we have constructed some specially for this purpose.

"We give below illustrations (Figs. 20 and 21) of our latest two types of 'Continental' levers,

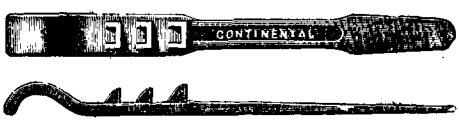


FIG. 20.

FIG. 21.

the advantages of which will be fully described in the following paragraphs.

"The lever illustrated in Fig. 21, patented in most countries, is extremely easy to manipulate, and renders the putting on of tyres an exceedingly simple matter.

"Drivers who wish to be able to quickly put on and take off the tyres should not fail to use both our levers.

"To put on the tyre:

First thoroughly clean the rim.

Put the tape inside the rim (for 85, 90, and 100 mm. tyres this is not necessary).

Put in studs with thumb-nuts.

"First, thoroughly clean the rim inside, remove all rust, sand and other foreign matter, etc., and enamel it. Should it be for any reason impossible to do this, use a good oil-paint, which would answer the same purpose. The chief object is to render the inner surface smooth, so as to avoid a risk of damaging the tube.

"If it is a wheel with wire spokes the tape supplied must be put on the inside of the rim in order to protect the tube from projecting spoke heads.

"As soon as the paint is dry, put the studs in their holes and screw the nuts losely.

"The wheel is now ready to receive the rubber tyre.

"*Putting in the Inner Tube into the Outer Cover, and attaching one side of the Cover.*

"Lay the cover flat on the floor, inflate slightly the inner tube with four or five strokes of the pump, and place it into the cover, taking care to prevent foreign matter (grit, stone, etc.) from getting into the cover, as it is likely subsequently to damage the tube.

"The slight inflation of the tube has for its object to prevent creases in the tube, which would very easily happen if this were not done.

"In putting the tube into the cover, the valve must be placed in two notches made in the edges of the cover for the purpose.

"Place the tyre on the rim, beginning at the valve hole and putting the valve through it. Press one edge of the cover with the hand into the rim, taking care to pull the studs outwards, *i.e.*, towards the hub.

"The pressing of the tyre into the rim can be only partially done with the hand. This operation must be completed with the help of a metallic lever.

"An entirely new tyre is, of course, more difficult to put on than one already used, but it will yield in a short time.

"After one side of the cover has been put on the rim, the studs will be found under the thickened edge (Fig. 22) instead of over, as they ought to be.

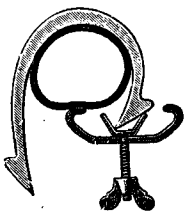


FIG. 22.

"To get them right, proceed as follows :

"Take both levers, and push them under the edges of the cover, one to the right and the other to the left hand side of the stud. Firmly press both levers with one hand, pulling the stud inwards with the other as far as possible (Fig. 23).

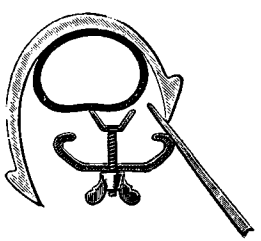


FIG. 23.

"Move the levers in the direction indicated by the arrow (Fig. 24), whereupon the edge of the

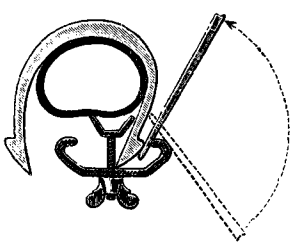


FIG. 24.

cover will fall into its right position between the stud and the rim. The same process is repeated with the other studs, and one side of the cover is then in place.

"*Slight inflation of the Tube (if not already done).*

"*Examining the Tube to see if it has been nipped.*

"The putting in place of the other side of the cover can now be proceeded with; but before doing so, it is best to make sure that the inner tube has not been nipped by the studs or by the side of the cover already in place. This precaution should not be omitted under any circumstances.

"Before placing the tube into the cover, it is slightly inflated, but the air may have escaped again in the meantime on account of the valve being only loosely screwed on, and should this be the case the tube must be slightly inflated once more. Do not omit to spread plenty of chalk on the inside of the cover.

"Now pass the hand between the cover and the tube to make sure that the latter has no creases. On arriving at the valve or at a stud, lift the tube slightly with the fingers at the same time pulling the valve or the studs outwards (Fig. 25).

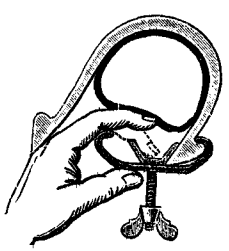


FIG. 25.

"If creases are found in the tube, straighten them. If, however, the tube is nipped by the valve or one of the studs, which can easily be ascertained by the tube offering resistance to the passage of the hand, press the studs inwards, and thus release the tube—only after making sure that the tube and studs are in their right position.

Proceed with the Attachment of the other side of the Cover.

Use our new lever in the manner indicated in Fig. 26, and put on the other edge of the cover in the usual way, manipulating the lever as shown in Fig. 27. Never apply the lever more

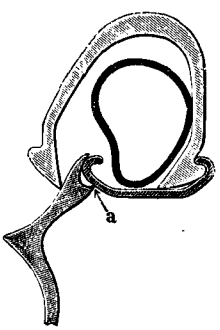


FIG. 26.

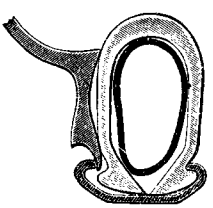


FIG. 27.

than 6in. from the point where the cover is already in place, as otherwise the attachment is rendered more difficult. When reaching the studs or valve, they should be pushed inwards into the cover, as already described in previous paragraphs, so as to get them over the edge, and not under.

The advantages of our new levers are as follow :

With levers hitherto used, it often happened that they got pushed too far under the tyre, and so pinched the tube (Fig. 28).

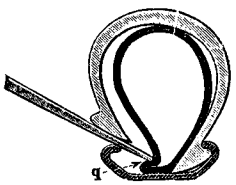


FIG. 28.

This can never happen with our new lever, as the hook with which it is provided fits the iron rim, and prevents the lever from touching the tube at all.

The second important advantage of our lever is that, owing to the angular projection on it, the cover can be put without exertion into the position it should occupy on the rim.

A wrong position of the edge or the bending over of the cover (Fig. 29), as is often the case

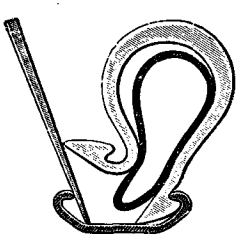


FIG. 29.

when ordinary levers are used, is entirely done away with when our levers are used.

Testing the Studs.

After the second edge of the cover is in position on the rim, the putting on of the tyre is finished and it only remains, before tightening the nuts, to make sure that the tube has not been nipped.

For this purpose the studs are pushed inwards into the tyre, and pulled back again (Figs. 30 and 31).

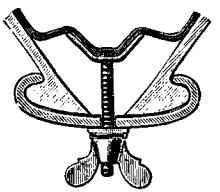


FIG. 30.

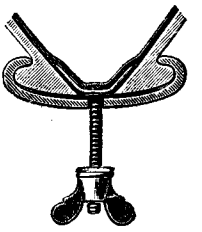


FIG. 31.

If this can be easily done, it is a sign that the tube is in its proper position. If, however, any resistance to that movement of the studs is noticeable, it means either that the tube has been nipped (Fig. 32) or that the cover is not in its proper position (Fig. 33), in which case the cover should be lifted slightly, with the lever at the spot in question, and the defect remedied.

FIG. 32.

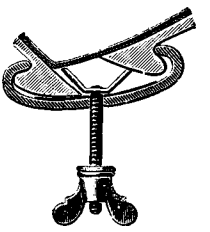


FIG. 33.

These precautions are absolutely necessary, and should under no circumstances be neglected.

Tightening the Valve and Nuts.

The nuts securing the valve to the rim and the thumb-nuts of the studs can now be tightened, which, however, *must be done by hand only*, and not with tools. No wrench or spanner should be used to tighten the nuts, as it will only damage them. *The tightening of the nuts with the hand is quite sufficient.*

Inflation of the Tube.

Inflate the inner tube to the full extent and again tighten the nuts, with the hand only

As to the valve, see that the nuts are tightly screwed down.

The attachment is now finished, and the tyre ready for use.

"(U.) TAKING OFF A COMPLETE CONTINENTAL MOTOR TYRE.

"*Deflate the Inner Tube and loosen the Thumb-nuts.*

"Unscrew the dust cap and nut of the valve, and allow the air to escape. This done, unscrew the thumb-nuts until they are right at the end of the studs.

"*Remove one Edge of the Cover from the Rim.*

"Insert one lever between the rim and the edge of the tyre (Fig. 34), doing the same with the second lever about six inches away.

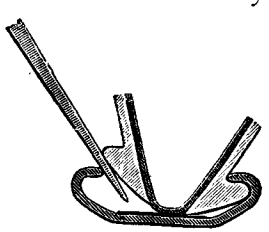


FIG. 34.

"Then press both levers down at the same time, thus lifting the edge of the cover out of the rim. Hold the first lever down, and lift the second lever up again, so that it assumes a vertical position as shown in Fig. 35.

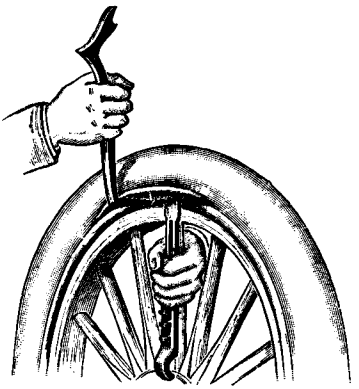


FIG. 35.

"Push the vertical lever gradually round the edge of the whole tyre, and so detach one side of the cover. On arriving at the valve or at the studs, push them inwards into the tyre.

"Always use the lever in a vertical position (Fig. 36) and not horizontal (Fig. 37), as this

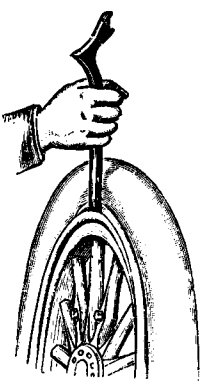


FIG. 36.

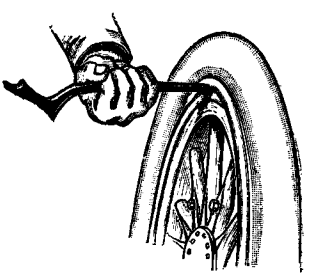


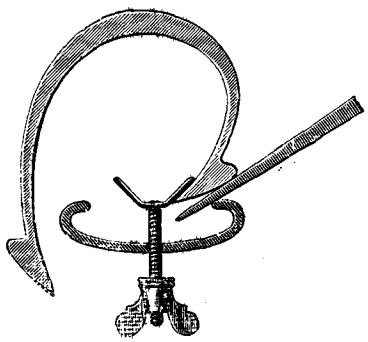
FIG. 37.

method renders the detachment of the edge more difficult.

"In this way one edge of the tyre is taken off.

"*Removing of the Second Edge of the Cover from the Rim.*

"Insert the levers between the cover and the rim, on each side of the studs, and lift the cover up (Fig. 38).



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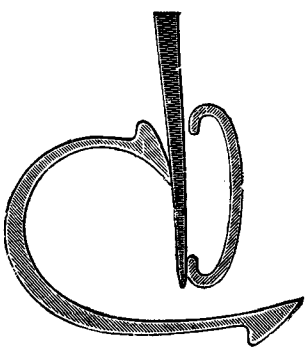


FIG. 39.

"Pull back the stud so as to bring its lugs right against the rim or tape. Having brought all the studs into that position, insert the lever under both edges of the cover (Fig. 39) and push it towards the edge already detached, beginning at the point opposite the valve. Pull the valve out of the valve hole, and the tyre is detached.

"V. CHANGING THE TUBE.

Removing the Old Tube.

"If the tube has become defective through any cause, and has to be replaced, proceed as follows :

"Remove one edge of the cover from the rim in the manner described in paragraphs one and two of the preceding instructions, leaving the other in position.

FIG. 40.

"Pull the tube out of the cover beginning opposite the valve. On coming to the valve, push the cover aside (Fig. 40) by means of our lever (Fig. 20), and pull the valve out of the rim.

"*Putting in a New Tube.*

"A new tube is put in the cover deflated. Unscrew the dustcap, and push the valve through the hole in the rim, lifting the cover by means of the lever, as shown in Fig. 41.

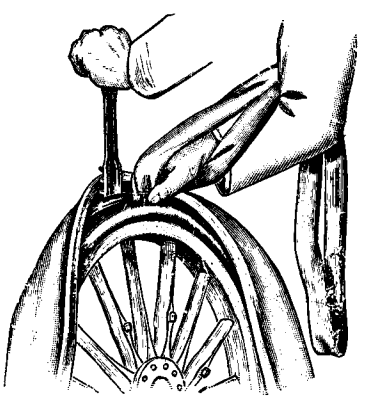


FIG. 41.

"Put the tube into the cover all the way round, without pulling or twisting it, and inflate it slightly, giving five or six strokes of the pump.

"Then examine the tube to see that it has not been nipped, and proceed with the fixing of the other edge as described in previous paragraphs.

"Having done this, tighten the valve and all the nuts and inflate the tube to the full extent."

The Company manufacture and retread tyres of all sizes. The following tables give only a few examples, and are intended merely to give the reader a general guide as to prices :—

To carry per wheel.	Size.		* Tyre complete without rim.	Cover.	Tube with long valve.	Rim, flat or rounded base.
	Millemetres.	Approximate inches.				
lbs.			£ s. d.	£ s. d	£ s. d.	£ s. d.
540	700× 75	·28×3	4 16 4	3 14 11	0 19 10	0 4 0
660	750× 85	30×3½	5 13 9	4 6 0	1 5 5	0 4 7
950	810×100	32×4	9 6 0	7 3 10	2 1 0	0 4 11
1140	875×105	34×4½	10 15 0	8 6 4	2 5 3	0 7 9
1300	920×120	36×5	11 19 8	9 5 6	2 10 10	0 9 2
2240	1000×150	40×6	27 1 6	20 11 0	6 3 0	0 15 0

* Tyre complete consists of outer cover, inner tube, and security bolts.

In all but the last of the above cases the cover is the round tread type. The square tread costs from 15*s.* extra, in the smaller sizes, up to 24*s.* extra in the larger sizes.

Flat metal rims are for wooden wheels.

Round metal rims for wire wheels.

Retreading beaded edge Motor Tyres.

Size.						Price.		
Millemetres.			Inches.					
						£	s.	d.
650	×	65	26	×	2½	1	1	7
700	×	80	28	×	3	1	9	2
750	×	85	30	×	3¼	1	13	3
810	×	90	32	×	3½	1	17	5
870	×	100	34	×	4	2	9	9
915	×	105	36	×	4¼	2	13	3
1020	×	120	40	×	5	3	3	4

With regard to motor tube repairs the following will enable the tourist to judge if he is being fairly treated by the local repairer, or not :—

Repairing small nail puncture, including patch, etc., costs from 11*d.* to 1*s.* 3*d.* according to size of tyre. For repairing small flint puncture the charge is rather more, *viz.*, from 1*s.* 4*d.* to 2*s.* 2*d.* Fitting 10-inch sleeve from 4*s.* to 7*s.* 2*d.* Fitting new valve tab from 1*s.* 7*d.* to 2*s.* 1*d.* The "Continental" motor repair outfits, size 3—price 6*s.* 6*d.*, will be found most useful. The box contains besides 1 small outfit size 1—2 tyre levers, 9 bevel edged patches, 1 large india-rubber patch, 1 large canvas repair patch, 1 roll of proofed canvas, 1 tin of solution, 1 roll of glass paper and 1 box of French chalk.

Address—

CONTINENTAL TYRE & RUBBER COY.,
104-108, Clerkenwell Road,
London, E.C.

Telegrams :—"Pneumique, London."

Dunlop Motor Tyres.

These tyres have probably a much larger sale in India than any other make of motor tyre. Dunlop pneumatics have been on the market for more than fifteen years. During the last few years the Company has had to fight hard to maintain its leading position in the United Kingdom. There is an evident intention to capture the Indian market. Dunlop tyres can now be obtained in several of the large cities of India, Burmah, and Ceylon.

The Company has established a depôt at 49, Apollo Street, Bombay, and placed it under the able management of Mr. W. S. Tinkler. As I have before stated, many of the firms carrying on motor business in India are managed and manned by persons who have received a dangerously superficial training in work in which they profess to be experts. The Dunlop Company have made no such mistake, but have sent out from England a gentleman who has been connected with the firm for several years, and who has thoroughly mastered every branch of tyre-construction.

In Mr. Tinkler, motorists in India will find not only a thoroughly capable business man, but also an enthusiast who is delighted to help the amateur with his professional advice.

To return to the tyre itself. In construction it is almost identical with the "Continental." In 1903 a non-slipping tyre was introduced. The

tread, which is thicker than the smooth tread, is moulded with a series of shallow lateral grooves at intervals of about two inches apart. This tyre takes a good grip of the ground, and with it a careful driver should not feel the want of any other non-skid.

Price List of Beaded Edged Smooth Tyres.

Size.		Tyre complete without rim.	Rim.	Cover.	Tube.
Inches.	Millimetres.				
		Rs. a	Rs. a.	Rs. a.	Rs. a.
2½ inches or 65 millimetres, to carry 450 lbs. per wheel.					
26	650	82 12	3 3	67 3	15 3
28	700	86 1	3 9	69 6	16 5
30	750	91 9	3 12	73 12	17 7
32	800	96 8	3 15	78 2	18 0
34	860	104 11	4 2	85 9	18 12
3 inches or 80 millimetres, to carry 500 lbs. per wheel.					
28	700	89 11	4 2	72 4	17 1
30	750	94 13	4 8	76 10	17 13
32	800	102 13	4 14	83 14	18 9
3½ inches or 85 millimetres, to carry 600 lbs. per wheel.					
28	700	94 6	4 11	76 6	17 10
30	750	101 2	5 1	82 3	18 9
32	800	106 5	5 7	86 7	19 8
3½ inches or 90 millimetres, to carry 900 lbs. per wheel.					
28	700	128 8	5 1	101 2	27 6
30	760	136 7	5 4	107 3	28 14
32	810	144 0	5 10	113 1	30 9
33	840	151 4	5 13	119 0	31 14
34	870	158 4	6 0	124 14	33 0
36	910	165 8	6 9	130 13	34 5
40	1010	182 12	7 5	144 2	38 4
4 inches or 100 millimetres, to carry 1,000. lbs. per wheel.					
32	810	178 5	7 2	143 10	34 5
34	870	194 0	7 11	156 2	37 8
5 inches or 105 millimetres, to carry 1,200 lbs. per wheel.					
34	850	206 9	9 6	167 15	38 4
36	920	217 15	10 2	177 1	40 8
40	1020	241 12	11 7	196 15	44 7

A foot pump and outfit supplied with each set of 4 tyres. Non-slipping covers at an extra charge of Rs. 10 per cover.

The above prices are subject to a discount of 5 per cent. if cash accompanies order, or 2½ per cent. against V. P. P.

List of Indian Firms who stock Dunlop Motor Tyres on Consignment Account.

Bombay Cycle Agency, Hornby Road, Bombay.

Govindjee Madhowjee & Co., Hummum Street, Bombay.

Mr. F. B. Ellis, 92, Cantonments, Agra.

Mr. F. K. Patel, Government Contractor, Mhow.

Addision & Co., Mount Road, Madras.

Simpson & Co., do. do.

Walker, Sons & Co., Ld., Colombo, Ceylon.

Watson, Allen & Roberts, 73, Merchant Street, Rangoon.

F. B. Stewart & Son, 1, Sholapur Road, Poona.

W. Leslie & Co., 2, Chowringhee, Calcutta.

Indian Cycle & General Engineering Co., Stafford House, Bangalore.

Address—

THE DUNLOP PNEUMATIC
TYRE Co., LTD.,
49, APOLLO STREET, BOMBAY.

Telegrams :—"INFLATOR, BOMBAY."

CLINCHER TYRES.

This well-known tyre is made at the Castle Mills, Edinburgh. In appearance it much resembles the Dunlop. The Clincher valve arrangement appears complicated, but in reality it will be found quite simple and very effective.

The following are the English prices for these tyres :—

Heavy Car Tyres.

Diameter in Millimetres.	Approximate inches.	Tyre complete with Tube, Security Bolts, and Rim.		Cover.		Tube with Valve. (Long Valves for Wooden, Short for Metal Spoked Wheels.)		Rim. (Flat Base for Wooden, Round Base for Metal Spoked Wheels.)	
		Code Word.	Price. £ s. d.	Code Word.	Price. £ s. d.	Code Word.	Price. £ s. d.	Code Word.	Price. £ s. d.
Section 65 m/m or 2½ inch, to carry 600 lbs. per wheel.									
760	26	Abaco	4 11 9	Accredo	3 7 11	Aequo	0 19 0	Amato	0 3 7
750	28	Abdico	4 17 4	Accendo	3 11 11	Aesto	0 19 10	Ambeo	0 4 0
950	30	Aberro	5 2 1	Accepto	3 15 10	Affecto	1 0 8	Ambulo	0 4 3
800	32	Abhino	5 6 10	Accerso	3 19 1	Affigo	1 1 5	Amico	0 4 4
810	33	Abigo	5 11 7	Accedo	4 3 0	Affino	1 2 3	Ampleo	0 4 7
860	34	Abjuro	5 16 4	Accubo	4 7 0	Affleo	1 3 0	Amputo	0 4 9
950	35	Ablego	6 5 10	Accuro	4 14 11	Affrino	1 3 10	Ancapo	0 5 2
1060	42	Abollo	6 18 7	Acquiro	5 5 3	Agerro	1 5 5	Antiquo	0 5 2
1150	46	Abrado	7 12 1	Adamo	5 15 7	Agneto	1 7 9	Annexo	0 6 7
Section 90 m/m or 3½ inch, to carry 950 lbs. per wheel.									
760	30	Baccatus	7 12 10	Bombus	5 10 1	Bucolus	1 15 9	Calculus	0 4 7
810	32	Battanus	8 0 10	Bonitus	5 16 4	Buteus	1 17 4	Catinus	0 4 11
840	33	Barbarus	8 8 0	Boreus	6 1 1	Buxeus	1 19 8	Catulus	0 5 1
870	34	Bardus	8 13 6	Brutus	6 5 1	Buxatus	2 1 3	Cavendus	0 5 3
910	36	Bastus	9 3 0	Bracus	6 12 2	Cadivus	2 2 10	Caupus	0 5 7
1010	40	Bellus	10 2 1	Bravus	7 6 6	Calcarus	2 6 0	Caecus	0 6 9
Section 100 m/m or 4 inch, to carry 1,000 lbs. per wheel.									
710	32	Celatus	9 13 6	Centurus	7 3 10	Cervarus	2 1 0	Charrus	0 7 2
830	34	Celcu	10 8 0	Cerdus	7 14 0	Caestus	2 4 6	Chordus	0 7 9
Section 105 m/m or 4½ inch, to carry 1050 lbs. per wheel.									
815	32	Cebus	10 7 8	Circus	7 14 6	Citrus	2 2 10	Clarus	0 7 2
875	34	Centus	11 2 9	Cirrus	8 6 4	Cladus	2 5 3	Clastus	0 7 9
915	36	Cippus	11 13 10	Cistus	8 14 4	Clamatus	2 7 8	Clavus	0 8 4
Section 120 m/m or 5 inch, to carry 1300 lbs. per wheel.									
820	32	Damor	10 17 2	Deceptor	8 0 10	Definor	2 6 0	Deligor	0 7 7
850	34	Dapor	11 7 6	Decimor	8 8 9	Deflior	2 7 8	Delutor	0 8 4
880	35	Dartor	12 0 11	Declinor	8 19 10	Deformor	2 9 3	Demetor	0 8 9
920	36	Debeor	12 8 10	Decollor	9 5 6	Defricor	2 10 10	Demolior	0 9 2
1020	40	Debitor.	14 1 6	Decurror	10 11 7	Defremor	2 16 4	Demulcor	0 9 11

Fitting new treads to old covers costs from £1 14s. 6d. to £5 6s. 2d. according to the size of the cover.

The Company, among numerous other accessories, sell a very neat "Tourist's Handy Case" containing repair outfit. This is made in two sizes: No. 1 for 85 and 90 m/m tyres, price £1-13-0, and No. 2 for 105 and 120 m/m tyres, price £1-18-6.

The following list of the contents of a No. 1 case gives a good idea of this useful accessory :—

(1) One brass box, containing 4 valve plugs, 4 washers, 4 valve discs (voiture), 4 bevelled patches 70 × 70, 4 of 60 × 60, 1 180 × 80, 2 nuts **H.** 2 nuts **C.** 2 centre pieces **B.** of valve (voiture), and 2 valve caps (instantaneous).
(2) Wood for cementing repair patches.
(3, 4, 5, and 6) Four tubes of French chalk.
(7 and 8) Two patches (cloth and rubber), 180 × 140 and 180 × 180.
(9) Two security bolts (long) for 85 and 90 m/m tyres (instantaneous).
(10) One roll fine canvas spread.
(11) One inflator tube (voiture), with connection (valve end) instantaneous.
(12) One brass box, containing 3 large tubes of cement.
(13) Two pieces of sheepskin, tanned, to protect wooden wheel from injury by the above laces.
(14) Two gaiters (rubber and cloth), Nos. 2 and 3.
(15 and 16) Two laces for above,—one of cord, the other steel wire.
(17) One large hollow lever.
(18) One hooked lever (medium).

Address—

NORTH BRITISH RUBBER COY.,
CASTLE MILLS, EDINBURGH,
SCOTLAND.

Telegrams : —"WEBA."

CHAPTER VI.

ACCESSORIES.

The H.-F. "Car" Vulcanizer.

This is an accessory that all motorists in India would do well to invest in. It is easily carried, even on a small car, as the whole apparatus packs into a box 9″ × 6″ × 6′, and weighs rather less than 20lbs. The difficulty of getting patches to hold is considerably increased in a hot climate, but a vulcanized puncture, or burst, is not open to this objection. The damaged portion of the tyre is remade. Fig. 1 gives an end view of the vulcanizer at work on an inner tube. For convenient storage on the car the machine is built in two sections, the upper portion fitting into the lower.

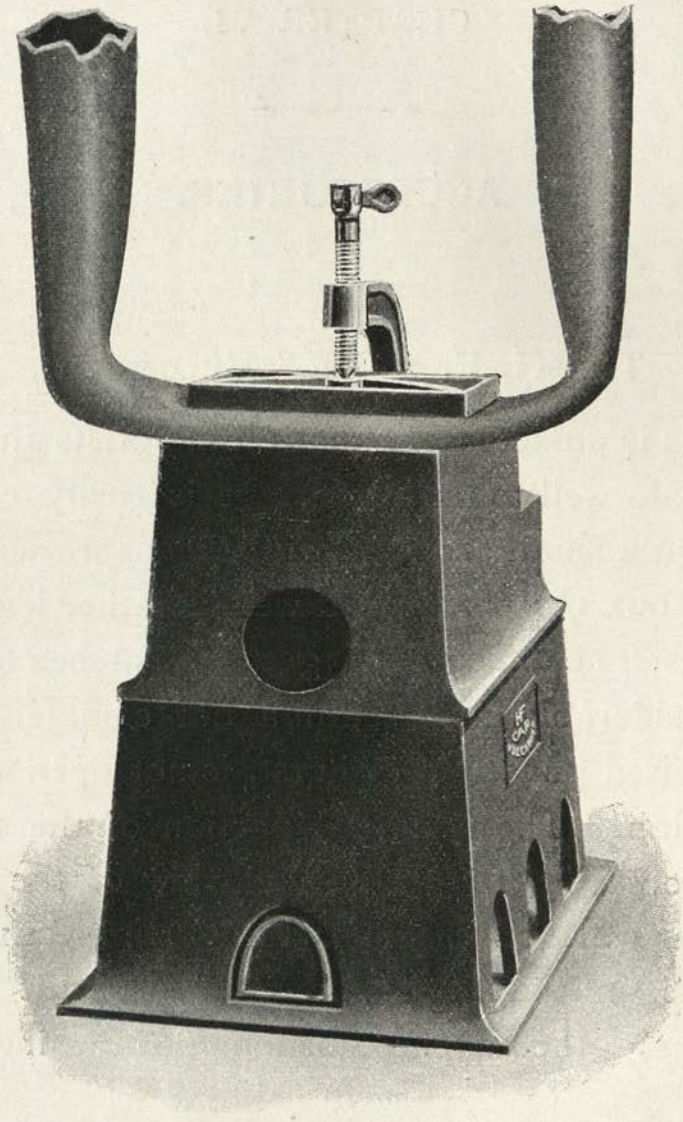
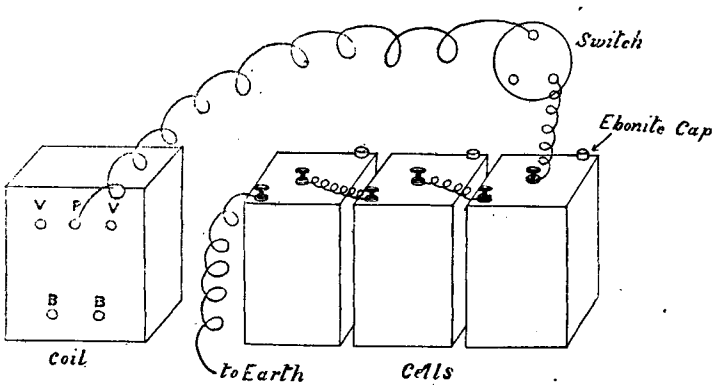


FIG. 1.

Siemens Transport Cells.

These cells are far more suitable for use in India than accumulators. A set of four cells, size XII, in a teakwood box, costs about Rs. 25. When received the cells contain no exciting solution and can be put away for an indefinite period without deterioration. In the same way, if, after being filled up with solution, they are not likely to be required for a week or two, the solution should be emptied out and the cells washed out with warm water.

To charge the cells a solution of sal ammoniac (5 ounces to one pint of water) should be injected by means of a glass syringe until the liquid reaches the top of the tube. The ebonite cap is then screwed on again. When first charged the cells will register about 1·5 each, so that three



Messrs. Siemens Bros., Ltd., 12, Queen Anne's Gate, London, are the makers. These cells can also be obtained from the K. & S. Cycle and Motor Car Coy., Tardeo, Bombay.

connected up in series will be sufficient. The central terminal is the + terminal and the corner one the — terminal. Suppose three cells were required, the wiring would be as follows :—Connect the + terminal of the first cell with the switch, and the — terminal of the same cell to the + terminal of the second cell, the — terminal of the second cell to the + terminal of the third cell, and finally the — terminal of the third cell with the "earth" wire.

In other words, the + terminal of the first cell and the — terminal of the last cell take the place of the + and — terminals of your accumulators.

The Lacre Motor Car Company.

This Company's catalogues should be in the hands of all motorists in India. They are five in number, *viz* :—

1. Motor Clothing and Accessories.
2. Lacre Industrial Vehicles.
3. Lacre Motor Bodies.
4. The Covering of a Motor Car.
5. Catalogue of Cars sold by the Company.

The goods supplied are of the best quality, and the catalogues give intending purchasers a very good idea of what the price of most motoring requisites ought to be.

1.—MOTOR CLOTHING AND ACCESSORIES.

(1) Clothing.

Ladies will find many useful articles in the Ladies' Department. Dust coats with specially made hoods at prices ranging from 17*s.* 6*d.* up to 4 guineas. Fur, seal, leather, tweed, and waterproof coats of innumerable designs moderate in price. Caps, hats, hoods, veils, masks and goggles. The caps and hats are, of course, only made in shapes most suitable for motoring. Hoods and veils are almost indispensible, the prices being from 10*s.* 6*d.* to 18*s.* Goggles and mica masks from 5*s.* to 11*s.* 6*d.* and ladies' driving gloves and gauntlets ranging from 7*s.* 6*d.* to £1 5*s.* per pair.

The Gentleman's Clothing Department is equally well stocked.

A very useful and comfortable coat in dyed seal, lined with tweed called the "Nansen" costing from 6 to 8 guineas would be suitable for the cold weather in the Punjab and elsewhere. Lighter coats fitted with wind cuffs would be equally useful further south. Washable dust coats made to measure range from 14*s.* 6*d.* upwards.

There is, of course, a large selection of leather garments, but these, with the exception of the waistcoats, are perhaps unsuitable for wear in this country.

Although waterproof coats are not often wanted in India as a protection against rain, still they are very useful, as they are not only light and take up very little room, but effectually keep out the dust and also afford good protection against the treacherous early morning wind, when travelling at high speed. The umbrella coat, with rubber neck-piece, absolutely keeps out dust and wind, and the "slip on" coat is almost as effective although made without the rubber neck-piece. These coats cost from 24*s.* to 55*s.* according to the materials of which they are made.

The use of ordinary travelling rugs by the occupants of the front seats of a car may result in a nasty accident should a loose corner interfere with the free use of the foot pedals. This danger is entirely obviated by the driving aprons sold by the Lacre Company. They are very comfortable and smart in appearance.

Caps, gloves and goggles are also stocked in large varieties.

(2) Accessories.

Lamps.—Most of the well-known makes can be obtained, *viz.*, Alpha, Bleriots, Bartlite, Helios, Ducellier, Lucas Salsbury, etc., using oil, gas and electricity. Head lights vary in price from £3-5-0 to

£15-15-0 a piece. Side lamps from £2-8-0 a pair, and tail lamps from £1-0-0 each.

Horn.—These cost from 7*s.* 6*d.* to £2-10-0. Flexible metallic tubes for motor horns cost from 8*s.* 6*d.* to 12*s.* 6*d.* according to length and diameter.

Bells—15*s.* each.

Funnels—From 9*d.* to 5*s.*

Oil Cans—From 4*s.* to 10*s.* 6*d.*

Side Baskets—From 35*s.*

Speed Indicators and Odometers—From £1-7-6 up to £13-13-0.

Lifting Jacks—From 10*s.* to £1-15-0.

Pumps—From 7*s.* to £2-2-0.

Voltmeters and Ampère-meters—From 8*s.* 6*d.* to £1.

Sparking Plugs—From 2*s.* 4½*d.* to 6*s.* 6*d.*

Fire-extinguishers—From £2 to £2-17-6.

Car Covers—Waterproof material in several sizes: Smallest, 7 ft. × 6 ft., costs 12*s.* 6*d.*; Largest, 21 ft. × 15 ft., £4.

Rubber-mats—2*s.* per lb.

"Lacre" Light Delivery Van.

2.—LACRE INDUSTRIAL VEHICLES.

Many of my readers may be interested in industrial vehicles, so a short description of the above well known type may not be out of place in a book which attempts to deal generally with the subject of Motoring in India. No doubt, in a few years the commercial van and lorry will be familiar sights on many of the trunk roads of India. Few of the existing roads and bridges are constructed to stand the strain of heavy motor traction, but there are thousands of miles of ideal roads for types which are capable of carrying loads up to two tons, on solid rubber tyres. A fairly high average speed is also necessary where long stages frequently have to be negociated.

The Lacre vehicles possess the following great advantages:—

(i) They are strongly and lightly built.

(ii) All types are driven by similar 16 h.p. two-cylinder internal combustion engines, thus securing economy in production.

(iii) The chassis is especially adapted to take solid tyres, and is so sprung that no vibration is communicated to the engine, passengers or cargo; consequently the running is smooth and comfortable, the engine is not jarred and the working parts are not unduly strained.

(iv) The gears are as nearly as possible "fool proof," and the control of the engine, which is automatic, is affected by one lever on the steering column.

(v) The cost of upkeep is reduced to a minimum by the small number of the working parts combined with strong and simple construction.

(vi) The engine is silent and the cars good hill-climbers.

The accompanying illustration serves the double purpose of shewing a popular type of body fitted to the chassis, and also the class of people who are satisfied with the practical value of these vehicles.

The following table has been compiled by comparison between the actual working of a number of Lacre one-ton vans in possession of prominent London business firms :—

Annual cost of running a one-ton Lacre van (costing, with sundries, £420) for 300 working days at an average of 60 miles per day.

	£	s.	d.
Interest on original outlay, at 5 p.c.	21	0	0
Driver, 52 weeks, at 30*s.*	78	0	0
Petrol for 18,000 miles	35	0	0
Grease, oils (lamp and lubricating)	5	0	0
Storage at 5*s.* per week	13	0	0
Insurance policy	10	0	0
Tyres per agreement with tyre makers	75	0	0
Renewals per agreement with Lacre Coy.	20	0	0
Annual repaint, etc., per agreement with Lacre Coy. ...	10	0	0
Cleaning at 10*s.* per week	26	0	0
Depreciation at 20 per cent....	84	0	0
	£377	0	0

This works out to 5*d.* per mile. In India the cost of petrol would be two to three times as great, but, on the other hand, the driver's wages would be less than a third of the sum shewn in the above estimate.

Details of a six weeks' test of Lacre vans, carried out by Messrs. Shoolbred & Co., are worth perusal :—

Date.	Started.	Returned.	Actual time.	Mileage.	Deliveries.	Petrol. Gals.	Oil. Gals.	Notes.
April.								
25th	11-20 a.m.	6- 5 p.m.	5 h. 15 m.	35	28	3	1	
26th	10-55 a.m.	7-55 p.m.	7 h. 30 m.	45	30	5	1	Tapet
27th	11- 5 a.m.	9- 5 p.m.	8 h. 30 m.	44	51	4	1	rod
28th	11-15 a.m.	7- 5 p.m.	6 h. 20 m.	38	32	4	1	
29th	11-20 a.m.	7-30 p.m.	6 h. 40 m.	42	42	4	1	
May.								
1st	11-10 a.m.	6-35 p.m.	5 h. 55 m.	43	17	4	1	
2nd	10-50 a.m.	5-50 p.m.	5 h. 30 m.	43	30	4	1	
3rd	11- 0 a.m.	7-25 p.m.	6 h. 55 m.	40	41	4	1	
4th	10-55 a.m.	6-40 p.m.	6 h. 15 m.	36	42	4	1	
5th	10-10 a.m.	7-10 p.m.	7 h. 30 m.	36	44	4	1	
6th	11-20 a.m.	7-35 p.m.	6 h. 45 m.	35	49	4	1	
8th	10-15 a.m.	6-55 p.m.	7 h. 10 m.	47	35	4	1	
9th	9-35 a.m.	5-50 p.m.	7 h. 45 m.	47	36	4	1	
10th	11- 5 a.m.	7-25 p.m.	6 h. 50 m.	46	37	4	1	
11th	11- 5 a.m.	7-15 p.m.	6 h. 40 m.	34	56	4	1	
12th	11- 5 a.m.	7-15 p.m.	6 h. 40 m.	36	42	4	1	
13th	11-25 a.m.	9- 0 p.m.	8h. 5 m.	51	61	4	1	
15th	9-35 a.m.	5- 5 p.m.	6h. 0 m.	70	1	5	1	
16th	11- 0 a.m.	8-30 p.m.	8 h. 0 m.	34	50	3½	1	
17th	10-55 a.m.	6- 5 p.m.	5 h. 40 m.	39	35	3½	1	
18th	10-55 a.m.	6-15 p.m.	5 h. 50 m.	37	40	3	1	
19th	10-50 a.m.	7-50 p.m.	7 h. 30 m.	40	38	3	1	
20th	11-15 a.m.	7-50 p.m.	5 h. 5 m.	45	42	4	1	
22nd	11-15 a.m.	7-45 p.m.	7 h. 0 m.	40	39	3½	1	
23rd	10-50 a.m.	7-50 p.m.	7 h. 30 m.	32	46	3	1	
24th	10-55 a.m.	7-50 p.m.	7 h. 25 m.	35	42	4	1	
25th	10-55 a.m.	8-15 p.m.	7 h. 50 m.	49	48	4	1	
26th	11- 0 a.m.	7-20 p.m.	6 h. 50 m.	35	43	3	1	
27th	11-15 a.m.	6-15 p.m.	5 h. 30 m.	39	40	3	1	
29th	11-15 a.m.	7-40 p.m.	6 h. 55 m.	42	56	3½	1	
30th	11- 5 a.m.	8-30 p.m.	7 h. 55 m.	35	54	3	1	
31st	11-10 a.m.	7-50 p.m.	7 h. 10 m.	44	37	4	1	
June.								
1st	10-50 a.m.	7-20 p.m.	7 h. 0 m.	34	53	3¾	1	
2nd	11- 0 a.m.	7-55 p.m.	7 h. 25 m.	51	39	4	1	
3rd	11-15 a.m.	6-30 p.m.	5 h. 45 m.	38	46	3¼	1	
5th	7-15 a.m.	3- 5 p.m.	6 h. 20 m.	30	1	4	1	
	5-35 a.m.	7-50 p.m.	2 h. 15 m.	16	16			

Tapet rod stuck, few minutes' delay, cleaned with paraffin.

1¼ hours deducted each day for meals.

Gear oil used :—

10th May ... 1 gallon.
18th May ... 2 gallons.
31st May ... 2 gallons.

Prices.

Vans complete with lamps, horn, etc. --

To carry 15 cwts., with solid rubber tyres.	£380
,, 20 ,, ,, ,,	£451
,, 40 ,, ,, ,,	£505

Lorries complete as above.—

To carry 15 cwts.; with solid rubber tyres, clear platform, 6 ft. × 5 ft.	£365
To carry 20 cwts., with solid rubber tyres, clear platform, 7 ft. × 5 ft.	£395
To carry 40 cwts., with solid rubber tyres, clear platform, 9½ ft. × 5¼ ft.	£490

Wagonettes and buses, to seat from seven to eleven persons, range from £420 to £510. The cases for the three sizes of chassis measure approximately :—

15 cwt. van or lorry	11 ft. × 6 ft. × 4 ft.
20 ,, ,, ...	13 ft. × 6 ft. × 4 ft.
40 ,, ,, ...	16 ft. × 6 ft. × 4 ft.

The reader can easily work out the approximate cost of landing any of the above cars in India by referring to information given elsewhere in this volume as to the usual charges for packing, freight, and customs duty.

When supplying these cars for work in tropical climates, the company are prepared, for an extra charge of £4-10-0, to increase the cooling water efficiency, by doubling the water tank capacity and specially constructing the bonnet to permit of the upper portion being raised to create a better draught.

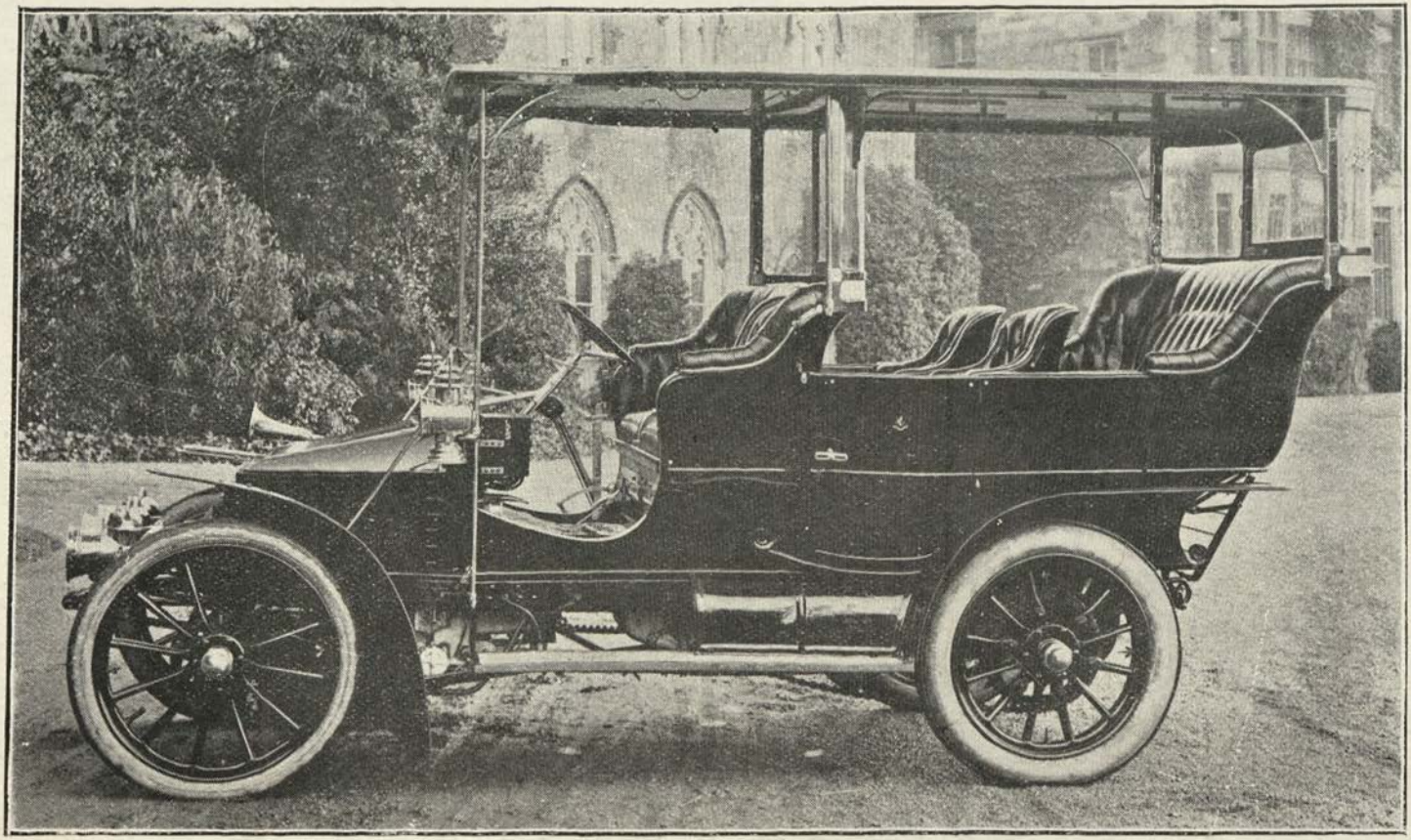
3.—LACRE MOTOR BODIES.

This is the branch of the business in which the Company has been pre-eminently successful. The highest class of carriage work for motor cars is turned out by their works in London and Hammersmith. Lacre bodies are to be found fitted to almost every make of chassis, English and Continental. The firm has realized that in hot climates woodwork is quickly distorted and destroyed, and they therefore recommend that the bodies of cars for use in India, Ceylon, etc., be constructed almost entirely of metal, aluminium being used not only for the panels, but also in the framework wherever possible.

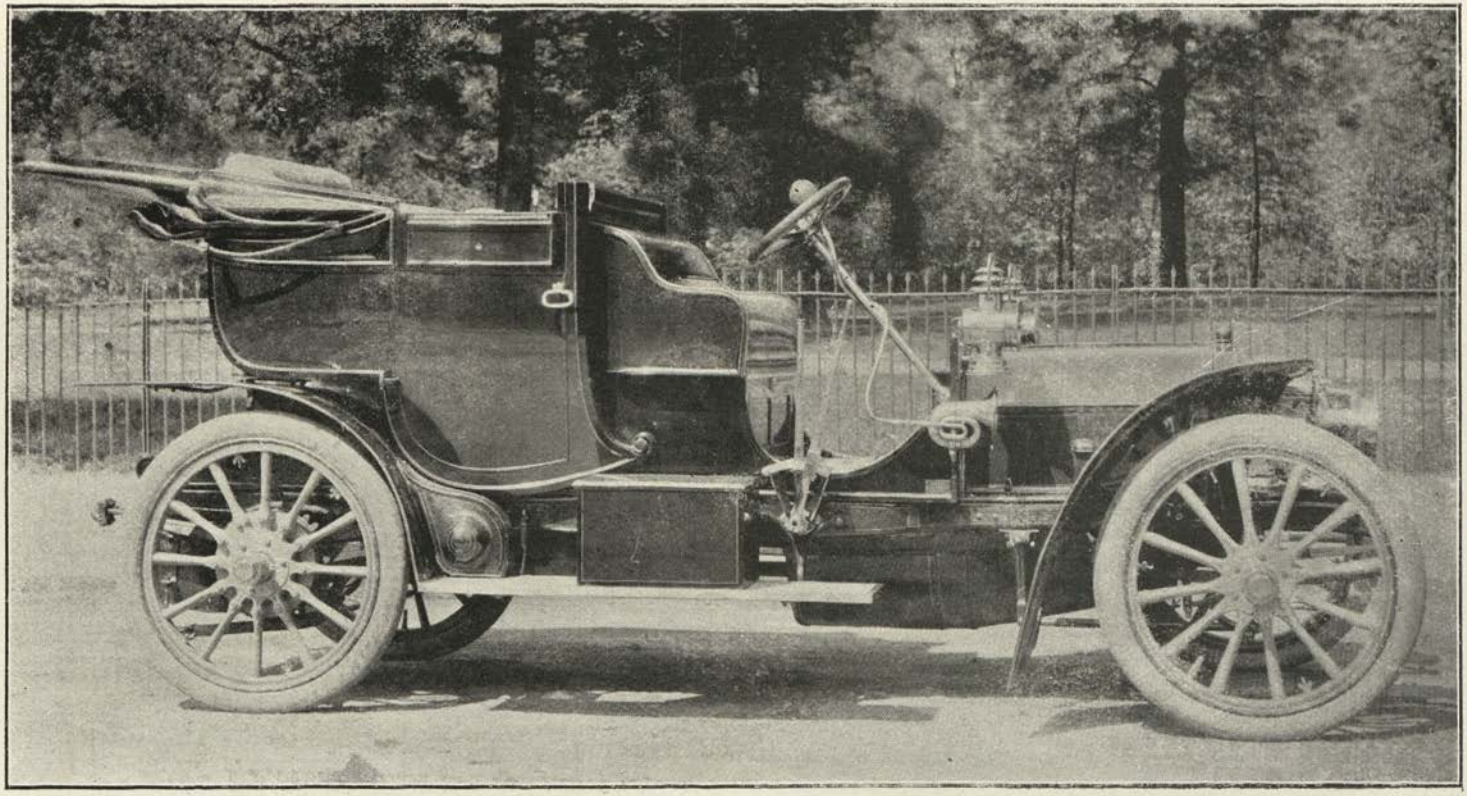
Plate A illustrates a handsome "Roi des Belges" type, Lacre body fitted to a Wolseley chassis. This car will seat seven persons comfortably. The two small seats near the side doors are semi-revolving bucket seats which can be removed, when the car is not carrying its full load of passengers, giving extra space for luggage. A luggage grid is also fitted at the back of the car for use on tours.

Plate B shews a single landaulette with top thrown open.

The above two examples are selected from a large variety. The Company are also prepared to build to the instructions and designs of their customers.



Lacre Motor (Plate A



Lacre Motor (Plate B).

The following list gives approximate prices for Lacre motor bodies :—

Tonneaus, from £50 upwards.

Side entrance types and phaetons, from £75 to £105.

Phaeton de luxe £115.

Tulip phaeton de luxe £125.

Semi Roi des Belges phaeton £145.

Full ,, ,, ,, £160.

Special ,, ,, ,, to seat seven £175.

Single landaulettes, fixed type, from £150.

,, ,, folding front type, from £165.

Double landaulettes, from £185.

4.—THE COVERING OF A MOTOR CAR.

In India, with an open car, a hood or canopy is almost a necessity. The only objection to the Cape cart and double extension hoods in general use in England, is that they are, as a rule, made of a rubber cloth which would be injuriously affected by tropical heat and the sun's rays. These hoods could be made of green willesden, or other stout canvas. A light canopy covered with the same materials might prove more serviceable, with the addition of side curtains and a glass screen.

Plate A shews canopy with curved glass screens, but without side curtains, fitted to a large side entrance car.

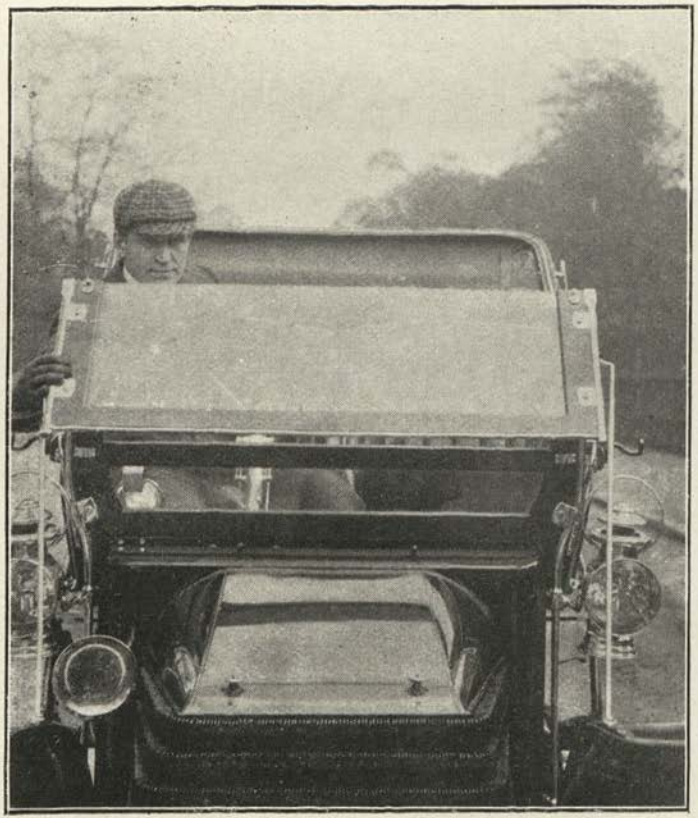


Plate C.

The centre glasses are made to slide up into the roof. Side curtains are fitted in all cases, these button down, overlap, and fasten together, so as to be perfectly weather-proof.

Examples of hoods will be found in various illustrations throughout the book. Lacre hoods vary in price from £15 to £30. Although hardly coming under the heading of this section I give here two illustrations (plate C) of a very handy folding glass screen. These photographs require no description.

CHAPTER VII.

DRIVING, CARE OF THE CAR, AND MINOR BREAK-DOWNS.

Driving.

The mere driving of a modern motor car is a much simpler matter than it appears to the uninitiated. Any one possessed of average nerve and common-sense can soon learn to take a car along ordinary roads at a fair speed without danger to himself and others. If accompanied by an experienced chauffeur, he need not devote more time to the study of the "interior economy" of his car than the average owner of carriage horses devotes to the management of his stable and coach house.

Neither the horse nor the car will do its work for long unless properly attended to. It is, however, much easier for a person with no previous experience to pick up the necessary knowledge in the case of the machine than in the case of the animal. In India competent chauffeurs are at present scarce, and the large majority of car-owners will not be prepared to go to the expense of engaging such a man. I shall therefore assume

that the reader intends not only to drive his car, but to undertake its management, with the assistance of a native servant whose work will be done under the master's directions and guidance.

Before making your first attempt to drive, study the mechanism of your car and commit the following list of instructions to memory. By getting into the habit of going through these operations always in the same order, either as they are here written, or as you yourself may arrange, no point will be omitted, and many a false start will be avoided.

(1) Run your eye over the car, and see that all nuts are properly secured.

(2) See that your brakes are in the proper position, namely, that when put at "off" they do not engage the drums at any point, and when "on" they engage evenly.

(3) See that you have sufficient lubricating oil in the oil-tank, and that the crank chamber, gear box, differential axles, steering mechanism, etc., have their proper allowance of oil or grease.

(4) Fill the petrol tank.

(5) Fill the water tank.

(6) See to your lamps; it is always as well to be prepared, even though you may set out with the intention of returning before dark.

(7) Make sure that your system of ignition is in proper order.

(8) Make a habit of always putting on the side brake when the car is standing.

(9) See that the speed lever is in the neutral notch.

(10) Turn on the petrol.

(11) Adjust the lubricating oil feeds.

(12) If a spray carburetter is fitted, flood the carburetter by lifting the float spindle.

(13) Put the switch button to the "on" position.

(14) Adjust the gas, ignition and air levers. At starting, the gas lever should be advanced to "fully open." The ignition fully retarded, and the air lever put to closed, or nearly closed.

Now get into the driving seat, and study the controlling mechanism until you can put your hands or feet at once on what you want, and move it instinctively in the right direction. You will notice two foot pedals close to the steering pillar, one on each side. The one to the left is the clutch pedal, the one to the right is the foot brake. By pushing forward the left pedal you separate the male and female portions of the clutch and thus break the connection between the engine and the driving mechanism behind the clutch, and therefore the impulse of the engine is

no longer communicated to the driving wheels, even if a set of gear pinions are in mesh. The car, if running, will soon stop from loss of momentum, unless on a down gradient.

By pushing forward the right pedal, a brake is applied, acting in proportion to the amount of pressure applied.

In case you require to stop suddenly, to avoid an accident, it is easy to remember that this can be done by pushing forward both these pedals firmly. To the right of the foot brake, will be found a third pedal, namely, the accelerator pedal. Practise until you can work these pedals without a moment's hesitation. In the same manner operate the gas, spark and air levers, also the switch. Next accustom yourself to work the hand brake and speed levers.

The beginner may think the above irksome and unnecessary, but I can assure him that an emergency having suddenly arisen, necessitating instant action, many a man (owing to his having neglected to practise the above) has been unable to act with sufficient promptitude, or has possibly operated the wrong lever with equally disastrous results.

Note.—The control system here described is to be found, with slight modifications, on many cars, but the reader must remember that there are many other systems of control, some of which have few points of resemblance.

Having made sure that the speed lever is in the neutral notch and the hand brake "on", get out of the car and start the engine. In the 10-12 Humber, as in most other cars, the starting handle is in front of the car, below the water tank. Standing clear of the handle, and grasping it lightly (in case of a back fire) bring the handle to its lowest point, press it in, until it engages the studs on the crankshaft, give a strong pull upwards, and the engine should start.

If it does not do so, after one or two attempts, there is something wrong. This subject is dealt with at the end of this chapter.

Now take your seat in the car. Disengage the clutch. Move the speed lever into the low gear notch, move the hand brake to "off", and let the clutch in slowly and gradually, at the same time depress the accelerator pedal slightly. If "let in" sharply, the male portion of the clutch will not be able to slip on the female portion, and as it is impossible for the driving wheels to instantly pick up the pace of the engine, the sudden jerk will probably stop the engine, and even if it does not do so, the strain on the mechanism will be enormous. Always start on the lowest gear for this reason.

Run the car a very few yards, and then take out the clutch, allowing the car to come to a standstill by loss of momentum.

Practise starting over and over again, and observe the effect of retarding the gas lever, advancing the spark, and increasing the air supply by lowering the air lever. Bring the car to a standstill by using the three following methods alternately with the one already described. 2nd method—Take out the clutch and apply the foot brake, by gradually increasing the pressure of the foot on the brake pedal. 3rd method—Take out the clutch, and put on the hand brakes by pushing forward the hand brake lever, until the pressure of the brakes is sufficient. The notched quadrant will hold the lever in the desired position. 4th method—Without disconnecting the clutch, switch off the current, and retard the gas and sparking levers. The compression in the cylinders acts as a powerful brake, especially when the speed lever is in the low gear notch : this last method can be employed with advantage when descending long hills. The current should be switched on again before reaching the bottom of the hill, otherwise it will be necessary to again make use of the starting handle.

Having acquired confidence in driving, steering, and stoping the car on the forward low speed, I strongly advise the beginner to devote his next lesson to repeating the same exercises, putting the speed lever in the reverse notch instead of the forward low speed notch. A few stones may now be placed to represent narrow tracks and awkward

turns, and the car driven backwards and forwards between them. The driver will very soon be in a position to house his car for the night without having to "get out and push."

The above will probably be as much as the average man will be able to learn comfortably on the first day. So we will suppose that he has successfully steered his car into its place for the night.

(1) He then takes out the clutch. (2) Puts the speed lever into the neutral position. (3) Applies the hand brake. (4) Switches off the current. (5) Retards the gas and spark levers. (6) Turns off the petrol and lubricating oil.

The cleaning of the car will also be referred to in this chapter.

On the second day the beginner should run through the first day's work, and if the result is satisfactory, he can proceed to run on the higher speeds.

Here again the method adopted in the Humber car is the one in most general use.

Start the car on the first speed and gradually increase the speed by advancing the ignition lever little by little and pressing the accelerator pedal right down. As soon as the maximum speed on the first gear is attained, retard the ignition lever about half way, and without wasting unnecessary

time take out the clutch, release the accelerator, at the same time moving the speed lever forward into the second speed notch, or near it, gradually let in the clutch, and accelerate the engine. During these operations the car is losing momentum, so it is obvious that the quicker done the better. If the speed lever is not exactly in the notch, it can be placed there now.

Remember that as the left toe goes down, the right comes up, and the right hand operates the speed lever. Then as the left toe comes up, the right toe goes down. The forward movement of the right hand should be rapid but under complete control. Should the gears fail to engage, take them out of mesh at once, and let the car come to a standstill. If you attempt to make them mesh by force, you may do serious injury to the teeth of the pinions.

To change back to first speed, release the accelerator gradually, this will slow the car down (otherwise the sudden change from second to low speed will cause considerable strain); as soon as the speed drops to the required pace, move the speed lever into the low speed notch, with a firm quick movement, and press the accelerator pedal right down. It is not necessary to take out the clutch when changing from a higher to a lower gear, but the beginner should, however, momentarily ease the clutch by a slight pressure of the left foot, while moving the speed lever.

The change from second to top speed is done in exactly the same way. The car should always be run on the top speed when possible, the vibration is less, the increased draft through the radiator keeps the engine cooler, and petrol is economized.

The following rules are worth studying :—

(1) Always start the car on the lowest gear.

(2) At the moment of changing gear, release the accelerator pedal.

(3) When starting the engine, open the throttle, retard the spark, and raise the air lever.

(4) Never drive the car at its utmost speed for long at a time.

(5) Keep the tyres well inflated and free from oil and grease.

(6) See that all parts requiring lubrication receive their proper allowance of oil or grease.

(7) Examine all nuts and bolts occasionally, to see that none have shaken loose.

(8) Use different strainers for petrol and water. In the case of the former, a piece of linen used over the strainer, will prevent water going into the tank with the petrol.

(9) The moment the engine begins to knock, retard the spark, and raise the air lever, or change to a lower gear.

(10) Take corners at a moderate pace. If travelling fast, take out the clutch at the bend, especially if the road is greasy.

(11) Use your brakes as little as possible.

(12) Beware of side-slip. This is a very real danger, more especially to the beginner. Travel slowly over greasy ground, as otherwise an attempt to pull up quickly, or to turn a corner, will cause the car to side-slip, and travel in a direction of its own choosing, the driver for the moment having no voice in the matter. Take out the clutch the instant the car shows signs of side-slipping and take off the brakes if on. One is inclined to try and counteract the side-slip by instantly turning the steering wheels in the proper direction. This is useless, unless the front wheels can get some grip of the ground, which they will not be able to do at the moment the side-slip begins; a slight pause is necessary before attempting to straighten up the car.

THE CARE OF THE CAR.

The purchaser can work out beforehand the initial cost of his car to a rupee; he cannot, however, estimate, even approximately, the sum he

will be called upon to spend per annum on its upkeep. This depends so much upon circumstances. He can, however, be certain of one thing, namely, that the amount of intelligent care and work he expends on the car will have a direct and considerable effect on the money question. This is the case in countries where qualified chauffeurs and repairers abound. In India the majority of motor firms are at present learning their trade at the expense of the car-owners. With few exceptions, the firms advertising to sell, overhaul, or repair motor cars, do so without possessing one single employé, or member of the firm, who has learnt any branch of the trade in a large motor workshop.

Good chauffeurs are at present scarce, and few owners will be prepared to go the expense of keeping such a man. It is essential, therefore, that the owner should know enough about "Mechanism and Car Ailments" to at least be able to "size up" the man to whom the "repairing job" is allotted. If he goes a step further, and really studies his car, from end to end, doing all minor repairs and adjustments himself, with time, care, and observation he will be able to dispense advantageously with professional assistance. The successful running of his car will repay him for all fatigue, dirt and anxiety.

Let him, before and during the run, see to the points enumerated in the chapter on driving.

On bringing the car back to the car-house, after its day's work, let the native servant at once clean off mud and dust. This should be done so as not to scratch the paint. Water is the best thing to use to remove mud. The trickle from a mussakh is quite effective, but care must be taken that water is not splashed on the engine while hot. The carriage work should then be dried and polished with soft cloth. The engine and machinery should be cleaned, dust, mud, and superfluous oil and grease being removed. The inside of the cylinders should be cleaned every day or two, by injecting about half a wineglass of petrol, or paraffin, into each cylinder, the starting handle being then turned for a minute or two.

In spite of the petrol being injected into the cylinders, the valves may become sticky. So occasionally remove the inlet valves and wash them thoroughly with paraffin or petrol; the exhaust valves can be washed at the same time without, however, removing them. If the valve faces shew any signs of pitting, or uneven wear, they should be ground true at once.

Valve Grinding.

The following is the process. Make a paste of the finest emery and oil, smear the valve face seating with the paste, using moderate pressure, revolve the valve backwards and forwards on its seating, until all dark spots are removed. Then wash clean with petrol or paraffin. In the case

of valves where the seating forms part of the engine, the greatest care must be taken (by stopping up the entrances into the cylinders, etc., with rag or waste) to prevent the emery powder getting into any part of the machinery, otherwise small particles will embed themselves in the metal and cause serious friction.

For this reason waste or rag that has been used for removing emery should be kept separate from other cleaning materials.

Another point of considerable importance in connection with the care of the engine, is the proper adjustment of the sparking lever. If the spark is kept retarded, the valves and cylinders will become badly burnt. As soon as the engine is started, gradually advance the spark to about halfway.

On the other hand, if the spark is advanced too much, the strain on the piston rod and connections will be considerable. The advancing and retarding of the spark should always be done little by little.

The crank chamber should be emptied every two or three days and fresh oil injected. At least once a month the engine ought to be thoroughly cleaned in the following manner. Drain off all old oil from the crank case, close the waste tap, and inject paraffin into the cylinders, turning the starting handle vigorously. Open the waste tap and drain off the paraffin. Repeat the operation

if necessary. When satisfied that all gummy deposit and dirt has been removed, inject a fresh charge of lubricating oil.

Now give the gear case its monthly clean-up. Drain off the oil, which by this time will probably contain small particles of metal. Fill the box about half full of paraffin, put on the lid, and start the engine, allowing it to run for a few seconds only. Run off the paraffin, and give the box its proper charge of oil or mixture of oil and grease.

Lubrication.

As the proper lubrication of all moving parts is of paramount importance, it is advisable to obtain with the car a chart showing every part that requires lubrication, also the brand of oil and grease recommended, and if it is lubricated automatically or by hand. In cases of automatic lubrication make sure that the feed pipe is not partially or entirely choked up. Where oiling by hand is necessary, do not leave this until you want to take out the car, or there is a good chance of some grease pots or oil holes being overlooked. When the car is brought to a standstill for any cause, it is well to find out if bearings, etc., are cool to the touch. Heat means undue friction. The systems of lubrication vary on different cars, so information should be obtained from the maker, including treatment of chains, differential gear, number of drops per minute at which the drip oil feeds should be set, etc., etc.

Most crank cases are furnished with a levelling cock. If, on opening this, a steady stream of oil flows out, too much has been given; if, on the other hand, no oil runs out, then the supply has been insufficient. Clouds of blue smoke denote the presence of too much oil in the cylinders.

It is better to give the machinery too much oil than too little, and to forget to turn on the oil feeds altogether (which is not so very unusual) may entail most serious consequences.

The Water Circulation.

Next to lubrication, and of almost as vital importance, comes the water circulation. Care should be taken not only that the tank is filled before starting, and no leaks exist, but also that suitable water (namely, water that will not deposit a sediment) is poured in through a fine strainer, the air tap being opened to prevent an air lock. If there is any chance of frost, all the water should be drained off, as, should the water in the tank or pipes freeze, they will, of course, be split open. This precaution is necessary in many parts of India in the cold weather. When the engine is running, the water may be circulated either by gravity (the hot water tending to rise while the colder tends to sink) or by means of a pump. In either case, should the circulation fail, or become weak, the engine will become abnormally hot. A test tap is generally fitted. If this is opened when the engine is running, a strong

jet of water should shoot out. Defective circulation may be due to the pump mechanism being out of order, a broken pipe, a leaking joint, an air lock, or some obstruction in the pipes. Pumps are of two types,—centrifugal and semi-rotary.

With the centrifugal pump the "bearings" are most likely to give trouble; with the semi-rotary the "valves" are liable to become choked up.

In case of an air lock, open all water-taps and plugs, start the engine, keeping the tank full by pouring in water as fast as it runs out. When the water circulates freely, close the taps and plugs.

Petrol Supply and Carburetter.

Great care should be taken, when filling the tank, that no water or dirt finds its way in with the petrol. If a fine strainer with a piece of linen is used, neither dirt nor water can pass through. Most carburetters have a small chamber underneath, which collects such dirt as finds its way through the feed pipe. This chamber should be cleaned out occasionally by unscrewing the cap below the float chamber. The cap must be screwed on again firmly, otherwise it may fall off, allowing the petrol to run out of the tank on to the ground. There are many ailments from which carburetters suffer, but these will be discussed elsewhere.

The Ignition.

The insulation of high tension wires should be occasionally looked to, and if any signs of chafing or wearing through are discovered, the cause should be ascertained and removed, and the place strengthened with india-rubber solution and insulating tape. Care should also be taken that the insulation is not burnt by coming in contact with the exhaust pipes, or any part of the engine likely to become overheated. Terminals are likely to become corroded. They should be occasionally scraped clean, and covered with vaseline. The loop at connection should be made from left to right, as the action of the screw in tightening up will tend to close in the wire. Sparking plugs should be examined to see that the porcelain is not cracked, the points proper distance apart, and that soot and dirt have not collected. Wash the plugs in petrol if necessary.

The three systems of ignition in general use are—

(1) The primary battery and induction coil.

(2) The secondary battery and induction coil.

(3) The magneto.

I intend here only to refer to these systems, in so far as affects their general supervision and care necessary to keep them in proper working order.

The primary battery consists usually of four cells : these should read not less than 1-1 per cell, or a total of 4-1. When new they should give a

total of 6. The secondary battery or accumulator consists, as a rule, of two cells, which, when fully charged, should read 2·2 each, or 4·4 volts for the whole battery. It should not be allowed to drop below 4 volts.

The method of testing both batteries is by means of a 4-volt lamp, or a voltmetre. The former gives an index of both voltage and amperage, the latter only of voltage. The testing should be done immediately after a run. With the lamp the wires should be connected up with the positive and negative poles of the battery: these poles are marked + and —, and the positive pole is generally coloured red. If the light is weak, it denotes that condition in either the amperage or voltage. Lengthy contact will do no harm.

The use of the voltmetre is somewhat similar. Each cell should be tested separately. The circuit is completed by placing one point of the voltmetre on to the positive pole and the other on to the negative pole; the indicator will then show the voltage. The circuit should be complete for as short a time as possible, otherwise harm may result to both the voltmetre and the cells. The dry battery, when exhausted, becomes useless. The accumulator can be recharged over and over again: this should be done slowly and uniformly, so as not to loosen the paste on the plates. The top of the plates should always be covered with liquid; any evaporation should be made up, by adding distilled water.

Thick oil and dirt are liable to accumulate in the commutator, so an occasional cleaning out becomes necessary. With the magneto system, the proper adjustment and running mechanism require occasional attention.

Brakes.

As the safety of the occupants of a car depends very often on the action of the brakes, the careful driver will always satisfy himself, on starting, that they are working effectively. In the stable he will ascertain whether they are properly adjusted or not, and if the connections are firm and strong, also that all parts requiring oil are properly lubricated. If after running with the brakes off the brake drums are hot to the touch, it is clear that some part of the brake is rubbing against the drum and adjustment is necessary. Oil on the brake surfaces can be easily and effectually removed with a little petrol.

Chains.

With chain-driven cars, the chains require a good deal of attention. After brushing off all the dust, the links may be cleaned with paraffin by the use of a suitable brush. They should be taken off every thousand miles or so, and thoroughly washed in a paraffin bath. After drying, a mixture of melted tallow and blacklead, or one of the specially prepared greases, should be rubbed well in, and the chain replaced.

Tyres.

Are dealt with fully in Chapter V

Clutches.

These differ so much from one another that it is difficult to lay down any rules regarding the best method of keeping them in order.

With the leather-faced clutch, care must be taken to insure proper lubrication of the bearings. Clutch springs may be either too weak, causing the male portion to grip the female portion insufficiently; or too strong, rendering it difficult to let in the clutch without a jerk. If the leather face is at fault, treat it with Fuller's earth to make it grip more firmly, or a little lubricating oil if too "fierce". Castor or linseed oil may be occasionally used to keep the leather in good condition.

Minor Breakdowns.

Cars are now built of such excellent materials, and the parts so carefully put together, that difficulties, unconnected with tyres, seldom occur; and when they do crop up they are, in nine cases out of ten, easily and quickly put right if the "man at the wheel" can rapidly diagnose the case.

Refusal to start, bad running, or stoppage, although rare, may arise from a considerable number of causes as will be gathered from the

following, by no means complete, list of internal combustion engine troubles :—

I.—THE ENGINE REFUSES TO START.

This must be due to one of the following causes : –

A. Operator's neglect or want of energy.

B. Some fault in the engine.

C. Faulty fuel supply.

D. Defective ignition.

A.—*Operator's neglect or want of energy.*

(*a*) Attempting to start the engine with no fuel in the tank, or with so little that none finds its way into the feed pipe. This latter is sometimes the case when the car stands on uneven ground.

(*b*) Forgetting to turn on the petrol supply tap. If there is petrol in the feed pipe the engine will run for a short time until the fuel in the pipe is used up, when it will naturally stop, and refuse to start until the tap is turned on again.

(*c*) Omitting to switch on the current.

(*d*) Not putting enough energy into the act of turning the starting handle.

In this connection it may be useful to remember that the risk of injury from a back fire may be avoided, in many cars of more than one

cylinder, by turning the starting handle with the switch off, and then switching on.

(*e*) The speed lever may not have been put at neutral, and (especially if the brake is hard on) the explosion fails to move the car sufficiently far. to cause a second explosion. The turning of the starting handle will of course cause the car to move forward, so the operator should at once realize what has happened.

B.—*Some Fault in the Engine.*

(*a*) Want of compression.

On turning the engine by hand considerable force should be necessary during the compression stroke. If the handle turns with little or no resistance there is a leak in that cylinder in which the piston is ascending on the compression stroke. The fault may be due to—

(1) A weak or broken valve spring.

If the spring is broken, this can, as a rule, be at once seen. With some inlet valves, however, the removal of a cover is necessary. The obvious remedy is to fit a new spring. This is not always an easy matter. The exhaust

valve spring is strong and often awkwardly placed. Special levers can be got which simplify this work. I have also found the following simple expedient very useful when putting the valve in place again. Before placing the spring back on its seating compress it to the required length, and keep it so compressed by tying it up with string at two opposite sides. When secured in position the strings can be cut, or the knots slipped, and the strings drawn out.

A good way of ascertaining if a spring has become weak, is to test it by means of a new spring of a similar kind. When pressed against each other both springs should shorten to an equal extent, or nearly so.

(2) Exhaust valve unable to close,—through valve spindle having become bent or dirty.

These defects can be remedied by straightening the valve spindle or cleaning it. Or, again, by some obstruction jambing the

valve open: this can be found and removed.

(3) Valves pitted or dirty.

If pitted they must be ground true as previously described in this chapter.

If dirty they should be washed in petrol.

(4) Gas escaping past the piston rings.

This can be detected by listening carefully while the starting handle is being slowly turned (with switch off). A slight hissing sound will be audible coming from the cylinder concerned. The cause may be traceable to one of three things. In the first place the open ends of the piston rings may have worked into line. A few vigorous turns of the starting handle will probably put this right unless, as in the second case, the rings have stuck in their groves. It will now be necessary to free the rings by washing with paraffin, and thirdly the rings may be worn, and require renewing. When the piston is withdrawn from the cylinder,

dull dark patches on the rings will mark the places where the gas has been escaping; elsewhere the surface will be smooth and polished.

(5) Leakage due to broken sparking plug, defective washer, loose nuts, cracked or porous cylinder.

These defects are sometimes very difficult to detect. The suspected places may be painted over with soap and water or smeared with lubricating oil and the starting handle slowly turned, the bubbles will then locate the leak; a lighted taper may also be held close to any possible leak when the escaping air will cause the light to flicker. The remedies are, a new plug, a new washer, tightening up all loose nuts, or a new cylinder.

(*b*) Too much compression.

This will mean that the cylinder walls are caked with dry oil, and that the cylinders have not been cleaned with petrol or paraffin as often, after the day's work, as they should have been.

C.—*Faulty Fuel Supply.*

(*a*) No petrol reaching the carburetter.

(1) Owing to the feed pipe being choked up.

When this is the case, no petrol will flow on removing the drain cap, generally fitted below the float chamber. To clear the pipes it will have to be disconnected and blown down, or the obstacle removed by means of a wire.

(2) Owing to the jet in the carburetter being choked up.

If the feed pipe is clear and still no petrol enters the float chamber, then there must be something stopping up the jet. To clean this out, it may be necessary to take off the float chamber cover and remove the float and spindle. A very fine wire should now be used, and great care must be taken not to damage or enlarge the jet opening. If the jet consists of a grooved cone, this can be removed with a key and the grooves cleaned.

(*b*) A weak mixture reaching the cylinder.

(1) Due to a leaky joint in the induction pipe connections, or inlet valve port cover.

This may be remedied by tightening loose nuts or may necessitate new washers.

(2) Incorrect adjustment of gas and air levers.

This can generally be corrected by varying the position of the gas and air levers. If this fails, it may be necessary, as a last resource, to change the petrol nipple and air funnel.

(3) The petrol may be stale, in which case it will have to be drained off and fresh spirit substituted.

(4) Water may be mixed with the petrol: drain off and pass it through linen laid in the strainer.

(5) When a mixture of petrol and paraffin is being used, it may be necessary, especially on a cold day, to start up with a larger proportion of petrol or even petrol only.

(*c*) Too much petrol.

The float needle may fail to cut off the petrol-supply at the right moment.

(1) The float needle may stick or be bent.

It must be cleaned and straightened.

(2) The float may be too heavy, and so keeps the needle valve open too long.

As a rule, this is due to the float leaking and letting in petrol. The leak must be found, and all liquid drained out, and the hole soldered up without making the float heavier than it originally was. This requires some care.

D.—*Defective Ignition.*

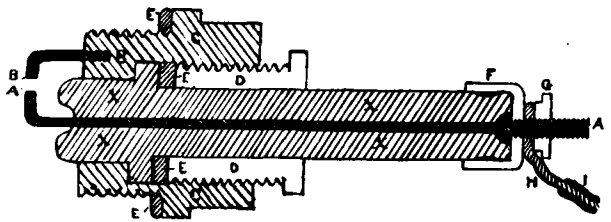
If you have two sets of accumulators, and the engine will not fire with the first set, switch over to the second set. If this set fires correctly you may conclude that the first set has run down and requires recharging. If, however, both sets give negative results, test your accumulators as previously described. If the reading is below 3·75, have the batteries recharged at once; if above 4, the cause of the mischief must lie elsewhere. Disconnect and take out the sparking plugs. Connect up again—place the plugs so that the metal portion of the plug only is in contact with the top of the engine. Now switch on the current and turn the starting handle. If no spark, or only a weak one, is the result, there must be a short circuit somewhere. Switch off and replace the

plug with a new one. If this plug gives a good spark, it is clear that the defect lay in the old plug.

This will be a convenient place to give a brief description of the

Sparking Plug.

Although there is a large variety of plugs, and the prices range from 1s. to £1, the general principle is the same in all. A spark is produced in the cylinder, whenever the circuit is complete, by forcing the current to jump a gap. In the accompanying diagram the gap is between the two points A and B.



A A′ central wire tipped with platinum running through the insulator XX (usually of porcelain or mica), BB′ is a wire also tipped with platinum screwed into the metal body of the plug CC, which, when screwed into the sparking plug hole in the cylinder, allows the current to pass to earth in the engine. EE, E′E′ are copper and asbestos washers, the former preventing gas escaping between the cylinder and sparking plug and the latter, when firmly compressed by the collar DD, makes the plug itself gas-tight. The electric wire

H, insulated by means of rubber piping I, is kept in place between the cap F and the wing nut G by screwing the latter down tightly on the loop made by H.

The business of the sparking plug being to give a good strong spark across the gap A B, it is of great importance that the distance between the points is neither too small nor too great. The correct distance is between $\frac{1}{60}$ and $\frac{1}{70}$ of an inch, or in other words about the thickness of an ordinary visiting card or thumb nail. If the points are too far apart the current will be unable to jump the gap, and if the points are too close, or the interval reduced by deposit of soot, the spark will be too small for the work required of it.

If soot is allowed to collect on the porcelain the current will run along it from A to C, thus avoiding the gap. The same will happen if the porcelain insulator is cracked. In the first instance the plug can be washed clean in petrol. Do not scrape the soot off with a knife, as this is apt to roughen the surface of the porcelain, and so facilitate the depositing of soot. In the second case it is better to change the plug, and leave the fitting of a new insulator to some more convenient time. Not unfrequently a short circuit is caused by oil collecting on the porcelain, due to over-lubrication. Petrol will quickly remove the oil, but this cleaning process will be necessary at intervals, until the excess of lubricating oil is used up. Water,

oil, or dirt may form a connection between F and D, the result will be a short circuit. Care must also be taken that no conducting material comes too close to the head of the plug. A long plug may come in contact with the bonnet when shut down. This contact may take place only occasionally, when the bonnet is jolted into nearer proximity to the plug than usual. If the engine does not misfire when the bonnet is raised, then suspect the bonnet.

If no fault can be found with either the accumulators or sparking plugs, and the terminals are all clean and tightly screwed up and the insulation neither burnt, by being too close to the exhaust pipes, nor cut, by chafing against a sharp edge, or a moving part, and also that no break in the wire can be found, there will still remain the commutator to be overhauled. It must be kept free from thick oil and dirt, and the spring should be strong enough to insure contact, and the contact pieces must be smooth and bright.

With Magneto-Ignition failures may be due to—

(1) Magnets having lost their magnetism.

(2) Incorrect adjustment.

(3) Defective insulation.

The first is not likely to occur except after long use and they will have to be remagnetised.

Incorrect adjustment means that the shield is not in the right position at the moment of firing.

Defective insulation not unfrequently arises where the wall of the combustion chamber is pierced.

II.—THE MOTOR PULLS FEEBLY.

Nearly all the examples already given apply equally here, the difference being merely one of degree. For instance, a slight loss of compression will seriously affect the power of the engine, although it may not be great enough to affect the starting of the engine. It is therefore sometimes very difficult to discover what is wrong.

(1) In multi-cylinder engines, one or more of the cylinders may not be doing its share of the work.

(2) Brakes may be rubbing, or left "on" by mistake.

(3) Accumulators may be giving out.

(4) The fuel supply may be interfered with.

(5) The pistons may be gripping for want of proper lubrication or through weak water circulation.

(6) The clutch may be slipping.

If one or more of the cylinders are missing fire, a simple test, and less painful than placing the bare hand on the exhaust pipes while the engine

is running, is to pass a strip of paper or material round the exhaust pipes and start the engine. The cylinders that are firing will be indicated by their exhaust pipes scorching the material where it touches them.

To ascertain if the brakes are rubbing, it will only be necessary to stop the car, and feel if the brake drums are hot. Overheating of the engine will generally make itself known by a slight knocking sound, accompanied by a hot smell. If the current is switched off, the engine will still continue to fire for two or three revolutions. The cooling water in the tank will be on the boil, unless the overheating is due to want of water or failure in circulation. Before filling the tank up, the engine must be allowed to cool, otherwise the sudden contraction of the metal may crack it.

If the lubrication is at fault, see that the pipe is not stopped up, or that the drain cock at the bottom of the crank chamber has not been shaken open or the screw plug dropped out. The cylinder should be well dosed with paraffin, and the engine turned by hand, until the piston rings work freely.

If the clutch is slipping, the friction will cause heat; the way to correct this fault has been already described.

III.—THE ENGINE SUDDENLY STOPS.

If the engine has been running with full power up to the last second, the cause will probably be—

(i) Fuel supply run short. This will cause the engine to stop suddenly and not

gradually as one would be inclined to think would be the case.

(ii) A small particle of grit or dust lodging in the jet, or a larger obstruction closing the feed pipe, may also produce the same result.

(iii) A sudden breakage or derangement in some essential part of the mechanism.

Before concluding this chapter, I would draw the reader's attention to certain sounds which the motorist should understand.

The first and most difficult to deal with, is a "squeak." This may be either quite harmless, or may indicate serious trouble. The lamps, springs, doors and bonnet frequently cause this sound. On the other hand, the squeak may be due to want of lubrication or derangement in some essential part of the machinery.

Tapping or knocking sound in the engine may mean that the ignition is too advanced, the engine overheating, or a looseness in some part of the piston connections, or something broken.

Sounds of small explosions coming from under the bonnet are due to several causes connected with the carburetter and induction pipe. As long as the running of the engine is not affected, no notice need be taken.

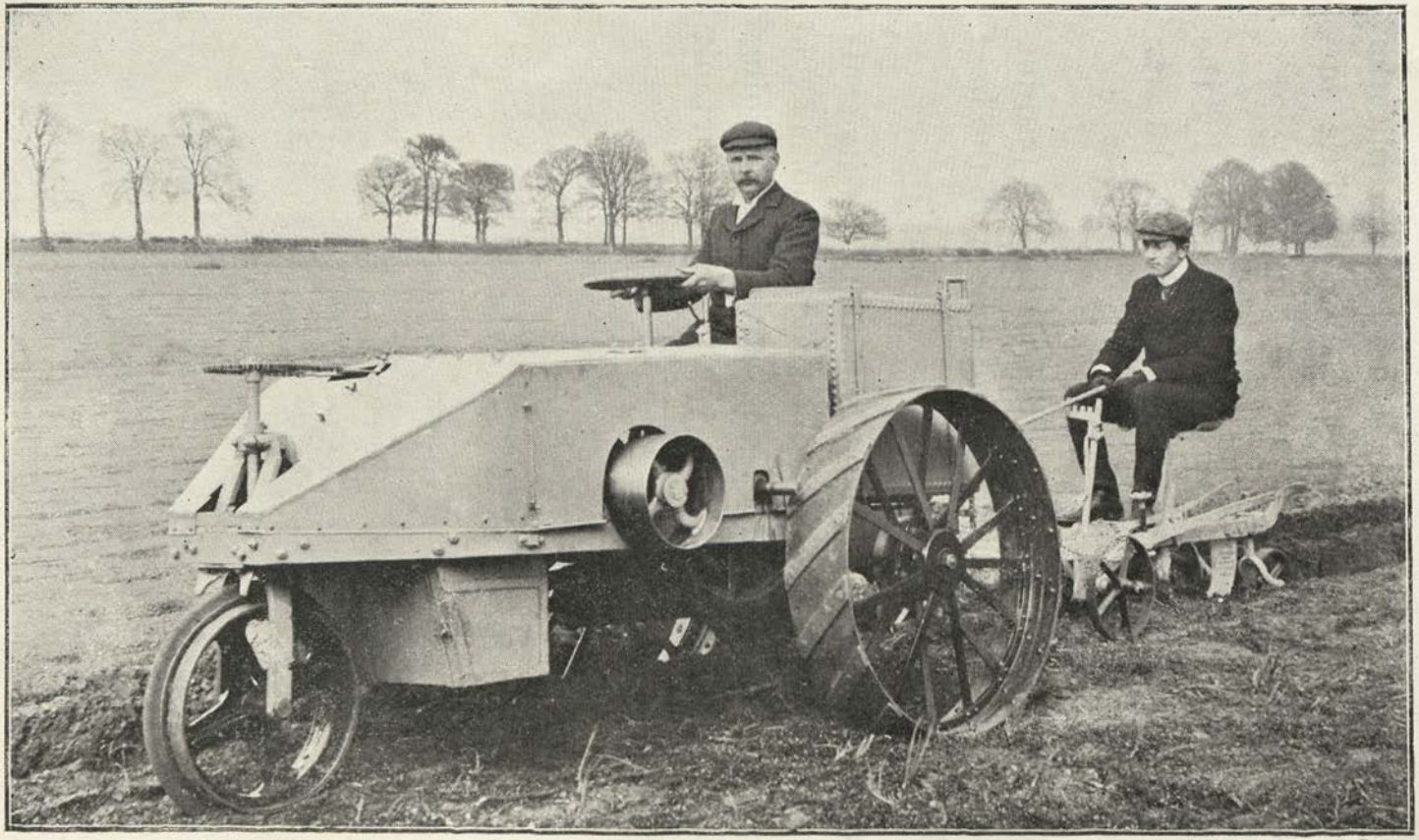
Loud explosions in the silencer are caused by unexploded charges from the cylinder being ignited

in the silencer. The result may be to split the silencer, but this is a matter of very little importance.

Stones thrown against the mudguards by the tyres make sharp noises which might be mistaken for the snapping of metal.

If the joints of the exhaust pipes leak, a panting sound will be produced, keeping time with the beat of the engine.

An automatic inlet valve vibrating on its seating, during the suction stroke, makes a noise such as might be produced by the rattle and scraping of loose pieces of metal in the cylinders or crank case.



Ivel Agricultural Motor.

CHAPTER VIII.

MOTORS FOR AGRICULTURAL AND MILITARY PURPOSES.

I.—Agricultural Motors.

The Ivel agricultural motor is now being used on many farms in the United Kingdom. The Company have also exported machines to France, Austria, Germany, Russia, Portugal, Hungary, Belgium, Algeria, Egypt, Australia, New Zealand, Tasmania and South Africa. During 1904 the Ivel motor obtained, among other medals, those of the Royal Agricultural Society of England and the Highland Agricultural Society of Scotland. These awards prove that expert agricultural opinion in England and Scotland places a high value on Mr. Albone's invention.

Some of the uses to which this machine can be put, are—

(1) Hauling any kind of 2 or 3 furrow plough, reaper, binder, cultivator, mowing machine, wagon, etc.

(2) As a stationary engine for driving threshing machines, chaff cutters, pumps, mills, dynamos, etc.

The following examples of actual work done by one of these motors may be of interest :—

(1) Hauling a 3 furrow plough, it ploughed 6 acres 1 rood 9 poles (of very unfavourable ground) to an average depth of 7 inches in 8 hours 54 minutes at a cost of 5*s.* per acre, all told.

(2) It cut 19 acres of wheat in 10 hours at a cost of 1*s.* 9*d.* per acre.

(3) It cut 9 acres of grass in 5 hours 13 minutes at a cost of 1*s.* 9*d.* per acre.

(4) It cut 21½ cwts. of chaff to a gauge of ⅜ inch in 47 minutes at a cost of 2*s.* 6*d.*

The motor has a two-cylinder internal combustion horizontal engine, giving 18 b.h.p. at about 700 revolutions per minute ; the fuel being petrol. The total weight of 30 cwts. is distributed over 3 wide wheels. The two rear wheels have a tread of nine inches.

The front wheel has also a tread of nine inches, but, as will be seen in the illustration a solid rubber tyre is fitted round its centre, thus giving it great gripping power. This enables the machine

to make very sharp turns. The pulley wheel on the left is for stationary engine work, the drive being carried on by means of a belt.

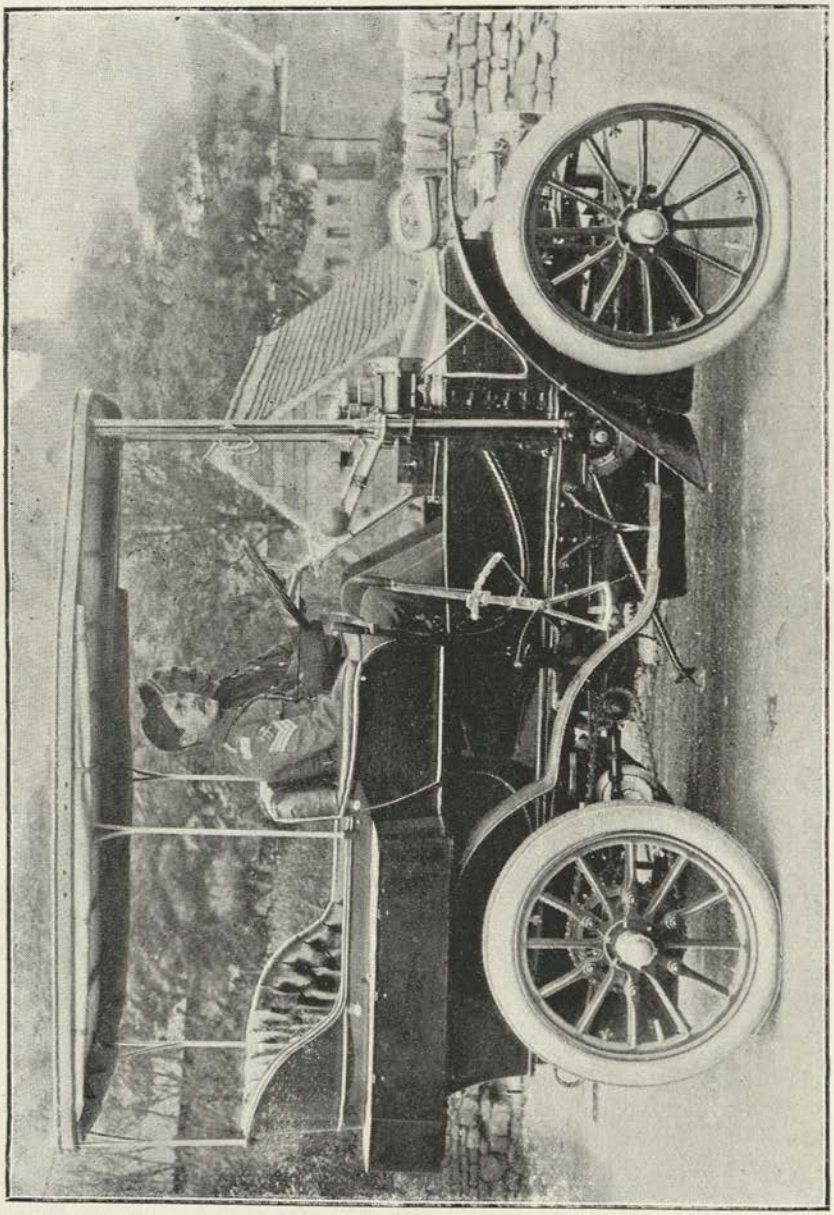
The price of the Ivel motor is	...	£ 300-0-0
Packing case and packing ...	...	£ 7-10-0

The crate measures 9 ft. 11 in. × 6 ft. 5 in. × 5 ft. 6 in.

Address—

THE IVEL AGRICULTURAL MOTORS, LTD.,
45, GREAT MARLBOROUGH STREET,
LONDON, W.

Telegrams: "IVEL, LONDON."



Military Motor.

II.—Military Motors.

Civil and military interests are very closely allied in India. This is particularly the case where the rapid development of automobilism is concerned. The best results will only be obtainable by mutual co-operation.

Even those who are in no way connected with the army cannot fail to realize the advantages to be derived by all motorists from the presence of Government motors and motor mechanics in the large military stations in various parts of the country. The present serious problem regarding a suitable fuel is undoubtedly capable of early and satisfactory solution, if taken in hand under the auspices of the Government of India.

The views of the British Government, as to the main object for which our army exists, have been clearly expressed by the Prime Minister in words and by Lord Kitchener in deeds.

A war on the scale foreshadowed would soon use up the available supply of transport animals, unless largely supplemented by mechanical vehicles.

The capability of British manufacturers to supply, at short notice, the full number of motors that would be required in the event of war, is

undeniable; at the same time the egregious folly of omitting to make adequate warlike preparations during times of peace, was forcibly brought home to the British nation on a very recent occasion. How is it then that so little is being done in this direction? The answer to this and many other similar questions is to be found in our extraordinary methods of government, which require that all (even the highest) officials shall be securely hobbled before being turned into their respective fields of labour. The erroneous idea that animal transport is cheaper than mechanical transport was, no doubt, put forward as a reason for the suppression of the latter.

The first duty of the British land forces is to insure the safety of the Indian Empire. At the present moment Russia is the only antagonist to be seriously considered.

A certain number of soldiers and politicians maintain that the existing natural barriers are sufficient to protect India from invasion by land, and that our best course, therefore, is to await the enemy on Indian soil. Apart from the fact that the possibility of invasion was, in the past, no mere fantastic dream, and that the advent of the motor has greatly simplified one of the most difficult problems connected therewith, we are unquestionably bound by the dictates of national

honour, no less than by considerations of strategy, to dispute the Russian occupation of Afghanistan with as large a force as possible.

Roads, and not mule tracks, will necessarily form all but a very small proportion of the lines of communication of our armies. The writers who assert that an invasion of India by land is unfeasible, base their most convincing arguments on the difficulty of maintaining the enormous numbers of non-combatants and animals that would be required by an army numerically strong enough to hold out any prospect of success.

The advent of the motor car has put a somewhat different complexion on the matter.

Some of the advantages to be secured by its use will be—

(1) A fifty to eighty per cent. reduction in the length of convoys.

(2) A corresponding reduction in camp and bivouac accommodation.

(3) The personnel will be counted by hundreds instead of thousands.

(4) The motor fuel and driver's rations will in bulk not approach one-tenth of that of the food for the equivalent in animals and their attendants.

(5) The movement of motors by rail and sea is infinitely simpler and cheaper than the similar movements of animals and carts.

(6) In large numbers, either dead or alive, animals are unsanitary.

(7) The replacing of broken down cars will be a cheap and easy matter as compared with the expense and difficulties connected with the filling up of gaps created by disease and overwork among the animals.

(8) Motors could be employed to lighten the strain on the artillery horses.

(9) Internal combustion engines require only a very small quantity of water for cooling purposes.

(10) The engines can be used as stationary engines, and in this form are capable of performing a variety of work that would otherwise have to be done by large numbers of men and animals.

(11) When not working, the motor costs nothing and does not deteriorate, whereas animals eat almost as much, and age as fast, when standing idle as when in full work.

The following simple illustration will, I hope, be found interesting as affording a comparison between motor and animal transport.

STATEMENT showing the number of Bullock carts (Government Bullock cart train) required for moving up 1,000 maunds supplies daily from Base to the Army in the field (9 marches) on the stage system, including food (less fuel) for attendants, and grain for animals.

	X Base	15 Miles (1)	30 (2)	45 (3)	60 (4)	75 (5)	90 (6)	105 (7)	120 (8)	135 (9)	Miles. Y
A { Carts ...	100	200	200	200	200	200	200	200	200	100	
A { Bullocks ...	218	436	436	436	436	436	436	436	436	436	
Carrying food for attendants and grain for animals at A + ditto for extra men and animals.											
Carts	40	75	64	53	44	35	25	16	8	2	
Total carts	**140**	**275**	**264**	**253**	**244**	**235**	**225**	**216**	**208**	**102**	
To complete sections, and allow for a few spare carts	3	5	6	5	4	2	6	4	1	2	
Grand Total Carts ...	**143**	**280**	**270**	**258**	**248**	**237**	**231**	**220**	**209**	**104**	
	3 Troops 2 Sections	6 Troops 3 Sections	6 Troops 1 Section	5 Troops 7 Sections	5 Troops 5 Sections	5 Troops 3 Sections	5 Troops 2 Sections	5 Troops	4 Troops 6 Sections	2 Troops 3 Sections	

Total carts required for whole line = 2,200.

A Government Bullock Cart Train has 440 carts and 960 bullocks—one spare pair bullocks is allowed on every alternate section (1 section has 6 carts and 12 bullocks and the next 5 carts and 12 bullocks) or 4 pairs for each troop of 44 carts, making a total of 40 pairs per train or nearly 9 per cent.

Note.—In the organisation no spare carts are allowed, so the few extra carts and bullocks which have been added on so as to utilise 5 trains, are very necessary and only amount to 38 carts with bullocks for the whole line.

Total required for the whole line = 5 trains = 2,200 carts and 4,800 bullocks

To perform the same work we should require (allowing 10 per cent. spare) 137 light cars. These cars would be capable of carrying a load of 28 maunds each, and average 180 miles a day, exclusive of one day's halt per week.

The calculation is as follows:—

Each car will complete the double journey in 3 days at 90 miles per day. Allowing for 1 day's halt per week each car will deliver 56 maunds at Y weekly.

* Number of cars + 10 per cent. spare = $\frac{1,000 \times 7 \times 11}{5 \times 10} = 137$.

The car is capable of working for many hours on end, not so the drivers. I therefore allow 50 per cent. additional drivers.

Establishment for a Bullock Train.

Details.	Train of Bullocks for L. of C.	5 Trains.
British—		
Officers	1	5
Warrant Officers	2	10
Native—		
Kote Daffadars	10	50
Veterinary Daffadars	5	25
Naicks	20	100
Lance Naicks	88	440
Drivers	441	2,205
Clerks	2	10
Bellowsboy	3	15
Blacksmiths	3	15
Carpenters	5	25
Hammermen	3	15
Shoeingsmiths	7	35
Peons	3	15
Weighmen	3	15
	596	2,980
Animals and Carts—		
Draught bullocks	960	4,800
Riding ponies	2	10
Carts	440	2,200

Establishment for Motor Train.

British—	
Officers	2
Warrant Officers	4
Native—	
Mechanics	12
Driver Mechanics (3 to every 2 cars) ...	205
	223

Statement showing original outlay under the following heads.

For 5 Bullock Trains.

	For one Train. Rs. a. p.				For 5 Trains. Rs. a. p.
Cost of clothing for Followers.	13,835	14	0	× 5 =	69,179 6 0
Cost of clothing for Native Fighting Men	315	15	0	× 5 =	1,579 11 0
Cost of clothing for British Warrant Officers	54	10	0	× 5 =	273 2 0
Cost of gear	10,818	7	1	× 5 =	54,092 3 0
Cost of carts	1,61,040	0	0	× 5 =	8,05,200 0 5
Cost of bullocks @ Rs. 50 ...	48,000	0	0	× 5 =	2,40,000 0 0
Cost of riding ponies @ Rs. 175	350	0	0	× 5 =	1,750 0 0
					Rs. 11,72,074 6 5

For Motor Trains.

	Rs. a. p
Cost of clothing for British Warrant Officers @ Rs. 75	300 0 0
Cost of clothing for Native establishment @ Rs. 50	10,850 0 0
Cost of 137 cars complete @ Rs. 4,500	6,16,500 0 0
Cost of extras such as spare parts, tyres, tools, etc., ordered with the cars	5,000 0 0
	Rs. 6,32,650 0 0

Statement showing recurring monthly expenditure.

For 5 Bullock Trains.

	Rs. a. p.
Pay of establishments	25,440 0 0
Rations for men	23,720 0 0
Rations for animals	36,075 0 0
Total	Rs. 85,235 0 0

For Motor Trains.

	Rs. a. p.
Pay of establishments	10,350 0 0
Rations for men	340 0 0
Fuel, lubricating oil, etc., all cars in full work	32,400 0 0
Total	Rs. 43,090 0 0

There are, of course, several items of expenditure not included in the above, but these, on examination, will be found to still further increase the balance in favour of the car. As an instance we will take the monthly depreciation.

In an arduous campaign this item would, in the case of bullock trains, probably amount to at least 5 per cent. on the original outlay per month: in other words about 60 per cent. per annum: in this instance in round figures Rs. 50,000 per month.

Under similar circumstances 4 per cent. per month would, in the case of cars, be ample to cover everything, including solid rubber tyres, if used on all cars: in round figures about Rs. 25,000 per month.

It should also be noted that, for every day the motor train is idle, a saving of about Rs. 1,000 occurs.

The reader can, by multiplying the above figures by from 50 to 100, arrive at a rough estimate of the amount of money, the numbers of men, animals or motors that would be involved, in the event of a war with Russia, for work on the lines of communication only.

CHAPTER IX.

FUEL FOR MOTORS.

Solid fuels, such as coal, coke and wood, which are only suitable for heavy traction work, need not be discussed here.

Solid fuel in the form of naphthaline (which was recently successfully experimented with by Messrs. J. E. Hutton & Sons in an ordinary internal combustion engine) could not be put on the Indian market at a sufficiently low price to insure its extensive use. The liquid fuels which concern us in India are three in number, *viz.* :—

(*a*) Petrol.

(*b*) Paraffin.

(*c*) Alcohol.

Each has advantages and disadvantages under varying conditions.

(*a*) Petrol.

This is the fuel in almost universal use for driving the engines of pleasure cars at the present day. It possesses many sterling qualities combined with several disadvantages.

The advantages briefly stated are—

(i) Gives good results in proportion to its weight and bulk.

(ii) Gives off vapour readily.

(iii) Is very cleanly, and makes little or no smell.

The disadvantages are—

(i) Requires to be handled with care.

(ii) Is difficult to put out when once it catches alight.

(iii) Evaporates rapidly if there is any leakage.

(iv) Is, at present, only obtainable in a few of the large towns.

(v) The charges for transport of petrol by rail are heavy, and the restrictions severe.

With regard to this last point it is understood that Government are about to issue new rules which will make the transport and handling of petrol easier. A drop in price should follow.

The following present prices may be found useful :—

Pratt's Motor Spirit.

Agra	Rs.	9·0	per 4-gallon drum	..	H. Pestonjee.
Bombay	,,	5·4	,, ,, ,,	..	Messrs Lalkaka & Co.
Bombay	,,	5·8	,, ,, ,,	..	Bombay Motor Car Co.
Calcutta	,,	6·8	,, ,, ,,	..	Standard Oil Co. Calcutta.
Delhi	,,	8·0	,, ,, ,,	..	Pearey Lal & Son.
Dhulia	,,	6·8	,, ,, ,,	..	Ardeshir Dalal.
Indore	,,	7·0	,, ,, ,,	..	Central India Cycle Agency.
Jullunder City ..	,,	8·8	,, ,, ,,	..	Bombay Motor Car Co.
Lahore	,,	10·8	,, ,, ,,	..	Walter Locke & Co.
Lu know ..	,,	9·0	,, ,, ,,	..	Oriental Motor Co.
Poona	,,	6·8	,, ,, ,,	..	Bombay Motor Car Co.
Rawal Pindi ..	,,	8·0	,, ,, ,,	..	,, ,, ,, ,,

In Bombay an allowance of Re 1 per 4-gallon tin and Rs. 2 per 8-gallon tin is made on empties being returned in good condition.

Assam Petrol.

This petrol is obtainable from the Assam Oil Company, 2, Clive Ghat Street, Calcutta, at the following rates :—

Re. 1 per gallon *ex* Moyapur Godown (17 miles from Calcutta).
Rs. 1-2 in Calcutta or delivered at railway station.
,, 1-2 *ex* Flat at Digha near Bankipore.
,, 1-2 ,, Fenchugunge.
Also Rs. 1-12 from M. A. Shakur, Johnstonganj, Allahabad.

This petrol is sold in 10-gallon drums. For these drums a charge of Rs. 10 is made. This is refunded on return of the drum, in good order, within two months from date of receipt.

The present freight on petrol is 1 pie per maund per mile at owner's risk and 1½ pies per maund per mile at railway risk. An 8-gallon tin weighs one maund when full.

The cost of licenses for storage and transport of petrol will be found on pages 251 to 262.

(*b*) PARAFFIN.

The great advantages connected with the use of paraffin as fuel are :—

(1) Low price.
(2) Safety.
(3) No vexatious regulations as to storage or transport.
(4) Obtainable everywhere.

Unfortunately there is another side to the picture :—

(i) The smell from the exhaust is most disagreeable.

(ii) It is impossible to prevent the paraffin finding its way to all parts of the car.

(iii) Being a heavy oil it does not vaporize so readily as petrol, and there is an inclination to foul the sparking plugs very rapidly.

This last objection is not a very serious one, as it can be overcome without much difficulty; but the two former, to my mind, put paraffin out of court entirely, as far as pleasure cars are concerned. Several carburetters have been made for using paraffin, notably by the Cremorne and Wolseley Companies. Vaporization is assisted by heating the carburetter, and by breaking up the fuel, on its way to the combustion chamber.

The following is a simple way of converting an ordinary petrol engine to use paraffin as well as petrol. In this case you require two tanks, one for each class of fuel. The feed pipe from the paraffin tank should lead to the pipe taking the hot water from the cylinders to the radiator, and be wound round it several times, and thence be carried to join the feed pipe near the carburetter. Cocks must be provided by which the supplies

of petrol and paraffin can be regulated. The heat from the exhaust pipes can be similarly made use of. The engine is "started up" on petrol and run on it until the paraffin has been sufficiently heated, when the paraffin can be turned on and the petrol supply cut off.

I will now take a case in which the motorist may find it necessary to use paraffin against his will. Suppose he runs short of petrol a hundred miles or so from the nearest replenishing station, and has to fall back on paraffin. Unless some precaution is taken the sparking plugs will very soon soot up. This can be prevented, as described in Chapter I, by stretching a piece of fine silk muslin or similar material across the lower joint of the induction pipe. This has the effect of somewhat weakening the force of the suction exerted by the engine, and consequently the engine takes longer to pick up, and the air throttle should not be opened to as great an extent as usual. I also found that the paraffin soon destroyed the asbestos washer at the joint mentioned, but this difficulty was overcome by substituting a rubber washer. It is of course always adviseable to keep a small supply of petrol in hand in case of an involuntary stop due to a puncture or other cause.

In other words, always carry a spare tin of petrol, which should not be opened—if paraffin is obtainable—unless necessity arises or you are within range of a further petrol supply.

The following are a few well known paraffin carburetters :—

The Cremorne.	The Roots.
,, Wolseley.	,, Parsons.
,, Simms.	,, Bryant Watling.

The Chaudel (petrol and paraffin).

(*c*) Alcohol.

The question of the production of cheap alcohol for fuel and industrial purposes is one which should interest this country very deeply. It may, however, be safely asserted that the matter has not, up to the present, attracted the serious consideration of the Government of India. The subject has been approached from one side only, and no attempt has been made to examine it from every point of view. I propose to put forward, in as few words as possible, some of the reasons why exhaustive enquiries are expedient.

During April 1905 the Departmental Committee appointed by the House of Commons to report on Industrial alcohol, concluded their investigations. On the subject of alcohol, as a fuel for internal combustion engines, the report says little beyond recording the fact that "mineralized methylated spirit would be quite suitable, but, unfortunately, the price is more than double that of petrol."

In Germany from 20,000,000 to 25,000,000 gallons of alcohol are distilled annually from potatoes. Almost the whole of this output is used as fuel for lamps, stoves, and engines. The German

Government motors all run on alcohol. In case of war these vehicles are independent of a foreign, imported fuel.

In Belgium nearly 1,000,000 gallons per annum of alcohol are used in various industries, of which the manufacture of artificial silk is the most important. The total annual consumption is about 1,500,000 gallons, namely, fifteen times as great as it was ten years ago, before the duty on industrial alcohol was removed.

In Europe we find that industrial alcohol can be retailed to the public at 10*d.* a gallon, and in several of our Colonies the cost of production (exclusive of duty, etc.) would be about half this amount, namely, 5*d.* per gallon. There should be no difficulty in producing a suitable spirit in India at a cost of 7 or 8 annas per gallon provided the consumption was considerable.

In the above three paragraphs we have—

(*a*) An authoritative statement to the effect that alcohol is a suitable fuel for motor engines.

(*b*) Two enlightened European nations who have decided that it is advantageous to permit the unrestricted production and sale of industrial alcohol.

(*c*) Data to prove that India can produce a fuel that, for mechanical, heating and

lighting purposes, is capable of taking the place of the greater part of the considerable imports of petrol and kerosine.

In speaking of the imports of petrol, it is not so much the amount of petrol actually imported that should be taken into consideration, as the results likely to arise in the future from the substitution of one class of fuel for the other. Owing to the rapid development of mechanical transport in Europe and America, the time cannot be far distant when the relation between supply and demand will cause a considerable increase in the price of petrol. Mechanical transport will then become too expensive for employment in this country, or an alternative fuel must be found.

I shall now endeavour to prove that so far from this enforced action being detrimental to the interests of this country, the opposite is the case. It will be necessary, in the first place, to draw a comparison between the two classes of fuel concerned.

(*a*) As regards capacity for work—Alcohol should compare very favourably with petrol owing to its greater range of explosibility ; in other words, the variation in proportion of air to vapour, capable of producing an explosion, is much greater in the case of alcohol than in the case of petrol.

(*b*) The alcohol engine can be run on a compression two to three times as great as that possible with a petrol engine.

(*c*) The petrol engine has a tendency to overheat unless the cooling arrangements are thoroughly effective. The alcohol engine, on the other hand, requires to be heated to obtain good results.

(*d*) There is no difficulty about starting a petrol engine, but with alcohol this (if the engine is cold) presents a difficulty as yet unsolved.

(*e*) Petrol is not mixible with water, whereas alcohol has an affinity for it. Alcohol will not burn if diluted with an equal quantity of water, salt or fresh. Petrol and paraffin will float on water and continue to burn. This, where marine engines in particular are concerned, is of very great importance.

(*f*) Alcohol does not give off vapour nearly so readily as petrol. This, although it causes more difficulty as regards starting the engine, makes the former fuel safer to handle and store.

Finally, it should be borne in mind that the petrol engine has, as the result of much labour, thought, and expense, been brought to a high state of perfection, whereas the alcohol engine has been neglected, and will continue to excite very little interest among manufacturers until they are convinced that a large supply of this fuel will be obtainable at a sufficiently cheap rate, to justify the expenditure of time and money on the necessary experimental work.

LICENSES.

The licenses which most concern the owners of motor cars are those on Forms I and J.

FORM I.

License to an owner of a motor vehicle or motor boat to possess or transport petrol upon such motor vehicle or motor boat granted under section 5 or section 6 of the Indian Petroleum Act, 1899 (VIII of 1899).

No. No fee required.

License is hereby granted to for the storage in the place described below of gallons of petrol required for use on his motor vehicle or motor boat, and for the transport on such motor vehicle or motor boat of such quantity as may from time to time be required for use therein, subject to the rules and conditions on the reverse.

This license shall continue in force for one year from the date thereof and may be renewed on application being made for this purpose not less than fifteen days previous to the expiry of the said year.

(*Description of the premises above referred to.*)

(Signed)

Secretary to the Government of Bombay.

Where the amount of petrol does not exceed forty gallons. { *or* Commissioner of Police, Bombay / *or* Resident, Aden. / *or* District Magistrate.

ENDORSEMENT ON FORM I.

Rules.

[Here enter rules 1, 2, 8, 9, 10, 11, 18, 19 and 29.]

Conditions.

This license is granted subject to the following conditions :—

1. When not carried in a receptacle forming part of a motor vehicle or motor boat the petrol shall not be kept, used, or transported except in iron or steel vessels so substantially constructed as not to be liable save by gross negligence or extraordinary accident, to be broken or become defective or insecure. Every such vessel shall be so constructed and maintained that no leakage, whether of liquid or vapour, can take place therefrom.

2. Every such vessel, when used for transporting or keeping petrol, shall bear the words "Petrol Highly Inflammable" legibly and indelibly stamped or marked thereon, or on a metallic or enamelled label attached thereto, and shall not contain more than four gallons and shall have an air space equal to 1/10th of its capacity to allow for expansion of the petrol.

3. Before repairs are done to any such vessel, that vessel shall, as far as practicable, be cleaned by the removal of all petrol and of all dangerous vapours derived from the same.

4. The store-house or building in which the petrol is stored shall be well ventilated and constructed of uninflammable materials.

5. Where a store-house forms part of, or is attached to, another building, and where the intervening roof or partition is of an unsubstantial or inflammable

character, or has an opening therein, the whole of such building shall be deemed to be the store-house and no portion of such store-house shall be used as a dwelling or as a place where persons assemble. A store-house shall have a separate entrance from the open air distinct from that of any dwelling or building in which persons assemble.

6. The amount of petrol which may be kept by the owner of a motor vehicle or motor boat, whether or not upon a motor vehicle or motor boat, shall not exceed sixty gallons at any one time.

7. The filling or replenishing of any vessel with petrol shall not be carried on, nor shall the contents of any such vessel be exposed, in the presence of fire or artificial light, except a light of such construction, position and character as not to be liable to ignite any inflammable vapour arising from the petrol, and no artificial light shall be brought within dangerous proximity of the place where any vessel containing petrol is being kept.

8. In the case of all petrol kept or transported for the purpose of, or in connection with, any motor vehicle or motor boat—

   (*a*) all due precautions shall be taken for the prevention of accidents by fire or explosion and for the prevention of unauthorized persons having access to any petrol kept or transported, and to the vessels containing or having actually contained, the same, and

   (*b*) every person managing or employed on, or in connection with, any motor vehicle or motor boat shall abstain from every act whatever which tends to cause fire

or explosion, and which is not reasonably necessary, and shall prevent any other person from committing such act.

Sections.

[Here enter sections 5 and 6 of the Act.]

FORM J.

General license to owner of a motor vehicle or motor boat to transport petrol, otherwise than on such motor vehicle or motor boat, granted under section 5 or section 6 of the Indian Petroleum Act, 1899 (VIII of 1899).

No. Fee, Rs. 5.

A general license is hereby granted to to transport petrol, in quantities not exceeding gallons at any one time, subject to the rules and conditions upon the reverse.

This license shall continue in force for one year from the date thereof and may be renewed on application being made for this purpose not less than fifteen days previous to the expiry of the said year.

(Signed)

Secretary to the Government of Bombay.

Where the amount of dangerous petroleum does not exceed forty gallons. } *or* Commissioner of Police, Bombay. *or* Resident, Aden. *or* District Magistrate.

ENDORSEMENT ON FORM J.

Rules.

[Here enter rules 1, 8, 18, 19 and 29.]

Conditions.

This license is granted subject to the following conditions :—

1. That the petroleum shall be contained in substantially constructed gas-tight tinned or galvanized

sheet iron, steel or lead plate drums or receptacles, each of not more than four gallons capacity and fitted with well made filling holes and well fitting screw plugs or with well made screw caps and metal air-tight undercaps.

2. That the drums or receptacles shall be so substantially constructed and secured as not to be liable except under circumstances of gross negligence or extraordinary accident to be broken or become defective, leaky or insecure.

3. That except when the drums and receptacles are made of tinned or galvanized sheet iron or steel, and are of the following thickness :—

	Not less than
(*a*) when the capacity does not exceed 2 gallons ...	25 B. W. G.
(*b*) when the capacity exceeds 2 gallons	22 B. W. G.

they shall be packed in strong wooden cases, the thickness of the wood being not less than half an inch.

4. That air space of at least one-tenth of its capacity is left in each drum or receptacle at the time of filling.

5. The petroleum shall be contained in receptacles labelled in accordance with section 7 of the Act.

6. The petroleum shall be carried (here describe mode or modes of conveyance).

7. Where the petroleum is transported by rail, it shall be subject to all the regulations which may, from time to time, be prescribed, generally or specially, in that behalf by the Railway Administration of the line over which it may be transported.

8. Where the petroleum is transported by steamer, it shall be stowed in such part of the steamer

and in such manner as may be approved by the licensing officer or any officer appointed by him in writing in this behalf.

9. Where the petroleum is transported by boat, no person shall smoke or kindle or carry any fire or light in or into the boat. The person in charge of the boat carrying the petroleum shall also, from sunrise to sunset, show at its stern a red flag, eighteen inches long and twelve inches broad, having the words "Petroleum Boat" marked on it in black letters.

10. Where the petroleum is transported by cart, the person in charge of any cart carrying the petroleum shall not permit it to move after sunset or before sunrise, or carry any light.

11. The licensee shall not deliver any quantity exceeding three gallons of the petroleum covered by this license to anyone who does not hold a license to keep the same under section 5 or 6 of the Act or any less quantity of petroleum otherwise than in accordance with the conditions of the proviso to section 6 of the Act as to the receptacles in which the petroleum must be placed.

It will be seen that certain rules are to be entered on these forms. Some of the rules need not be quoted, but I give others, as a knowlege of them may be useful to owners who have to transport their petrol a considerable distance by rail.

Although 60 gallons of petrol weighs less than 8 maunds, some lines insist upon charging for "not less than 20 maunds."

RULE 4.

4. Licenses for keeping dangerous petroleum other than in bulk shall ordinarily be granted only on the following conditions, namely—

(*1*) Where the quantity exceeds 40 gallons, that

(*a*) the building in which such petroleum is to be stored is constructed of masonry or other uninflammable material with a terraced, tiled or iron roof and a tiled, paved or earthen floor ;

(*b*) the premises in which such petroleum is to be stored are so arranged as to contain all the petroleum in case it escapes from its receptacles ; this arrangement to be effected either by leaving an interval between the level of the floor and level of the doors and other openings or by surrounding the building with a masonry wall or embankment or by a combination of these two methods ;

(*c*) the following distances are kept clear from the protected works round such building :—

Quantity to be stored.	Distance to be kept clear when dangerous petroleum is stored in drums or receptacles of capacity not exceeding 4 gallons.	Distance to be kept clear when dangerous petroleum is stored in drums or receptacles of capacity exceeding 4 gallons but not exceeding 10 gallons.
Gallons.	Feet.	Feet.
Not exceeding 1,000	25	30
Exceeding 1,000 but not exceeding 5,000...	40	50
,, 5,000 ,, 10,000...	60	70
,, 10,000 ,, 15,000...	90	100
,, 15,000 ,, 20,000...	130	150
,, 20,000 ,, 30,000...	180	200
,, 30,000...	200	200

(2) Where the quantity does not exceed 40 gallons, that

(a) the building in which such dangerous petroleum is to be stored is well ventilated and all parts thereof, except the doors and windows which may be of wood, are constructed of masonry or other uninflammable material ;

(b) where such building forms part of, or is attached to, an office or dwelling house, there are separate entrances and the intervening floor or partition is substantially built of uninflammable material and not perforated by openings.

RULE 8.

Notwithstanding anything contained in rules 3 and 4, a special license in Form I, for the possession of any stated quantity, not exceeding sixty gallons at any one time, of petrol, may be granted to the owner of a motor vehicle or motor boat by the Local Government, or (if the stated quantity does not exceed forty gallons at any one time) by the licensing officer duly authorized under rule 21.

15. Licenses for the transport of dangerous petroleum shall ordinarily be granted only on the following conditions, namely—

(1) that it shall be contained in substantially constructed gas-tight tinned or galvanized sheet iron, steel or lead plate drums or receptacles each of not more than 10 gallons capacity and fitted with well made filling holes and well-fitting screw plugs or with well made screw-caps and metal air-tight undercaps ;

(2) that the drums or receptacles shall be so substantially constructed and secured as not to be liable, except under circumstances of gross negligence or extraordinary accident, to be broken or become defective, leaky or insecure ;

(3) that except when the drums and receptacles are made of tinned or galvanized sheet iron or steel, and are of the following thickness :—

(a) when the capacity does not exceed 2 gallons ... ... Not less than 25 B. W. G.

(b) when the capacity exceeds 2 gallons but does not exceed 4 gallons ...Not less than 22 B. W. G.

(c) when the capacity exceeds 4 gallons. Not less than 16 B. W. G.

they shall be packed in strong wooden cases, the thickness of the wood being not less than half an inch ;

(4) that air space of at least one-tenth of its capacity is left in each drum or receptacle at the time of filling.

18. The special license in Form I, may permit the transport of "petrol" upon the motor vehicle or motor boat of the holder thereof; and such licensee may be granted a general license in Form J.

Duties and powers of Police.

19. (1) It shall be the duty of all Police officers of or above the rank of Police Inspector in the case of the license granted under rules 8 and 18, or in other cases of Constable to see that petroleum which is being transported under a license or pass is transported only in the manner prescribed by the conditions of the license under rules 8 and 18, or in other cases rules 11 to 16 and by such route as is specified in the license or pass.

(2) Any such officer may stop and inspect any petroleum in transit and, if necessary, require the person in charge of the same to comply with these rules or with any of the conditions of the transport license or pass.

Provided that no Police officer below the rank of Police Inspector shall stop a motor vehicle, or motor boat or

inspect the petroleum transported on such motor vehicle, under this sub-rule.

Grant of Licenses.

Application for licenses under section 5.

20. (*1*) Every application for a license, under section 5 of the Act, to keep or transport dangerous petroleum, exceeding forty gallons in quantity, shall be made—

(*a*) in the City of Bombay, to the Commissioner of Police,

(*b*) in Aden, to the Resident, and

(*c*) elsewhere, to the Commissioner of the Division, or in the case of a license under rules 8 and 18, to the District Magistrate,

who shall, after such inquiry (if any) as may be necessary, forward it with his opinion to the Local Government.

(*2*) Where the application is granted, the license shall be forwarded to the officer to whom the application was made, for despatch or delivery to the applicant.

Application for other licenses.

21. Every application for a license (other than a license under section 5 of the Act) to keep or transport petroleum shall be made to the licensing officer hereinbelow authorised to grant such license, namely :—

Nature of License.	Place of Application.	Licensing Officer.
(1) For keeping dangerous petroleum, in quantities not exceeding forty gallons, by one person or on the same premises.	(1) The City of Bombay.	(1) The Municipal Commissioner, or in the case of licenses under rules 8 and 18, the Commissioner or Deputy Commissioner of Police.
(2) For keeping petroleum, in quantities exceeding five hundred gallons, by one person or on the same premises.	(2) Aden. (3) Elsewhere.	(2) The Resident. (3) The District Magistrate or such other officer as the Local Government may, by notification in the local official Gazette, authorize in this behalf.

Nature of License.	Place of Application.	Licensing Officer.
(3) For the transport of dangerous petroleum in quantities not exceeding forty gallons.	(1) The City of Bombay.	(1) The Commissioner or Deputy Commissioner of Police.
(4) For the transport of petroleum in quantities exceeding five hundred gallons.	(2) Aden. (3) Elsewhere.	(2) The Resident., (3) The District Magistrate or such other officer as the Local Government may, by notification in the local official Gazette, authorize in this behalf.

22. (*1*) Every application for a license for keeping or transporting petroleum shall be in writing.

* * * * *

(*4*) Every application for a license, under section 5 of the Act, for keeping or transporting dangerous petroleum other than an application for a license under rules 8 and 18 shall also specify, to the best of the applicant's knowledge and belief,—

(*i*) for what purpose the petroleum will be used ; and

(*j*) that petroleum, other than dangerous petroleum, cannot be used for that purpose.

(*5*) Every application for a license under rules 8 and 18 shall specify—

(*a*) whether the applicant is an owner of a motor vehicle ;

(*b*) the amount of petrol which the applicant desires to store ; and

(*c*) the exact position and nature of the premises intended to be used for the storage of such petrol, and whether the said premises fulful the conditions contained in Form I.

27. The following fees shall be charged for licenses (other than those granted under rules 8 and 18), whether original or renewed, for keeping or transporting, as the case may be, dangerous petroleum :—

Fees for keeping or transporting dangerous petroleum.

	Rs.	
Licenses to possess dangerous petroleum—		
where the quantity does not exceed forty gallons ...	3	
where the quantity exceeds forty but does not exceed five hundred gallons ...	8	
where the quantity exceeds five hundred but does not exceed one thousand gallons	12	
where the quantity exceeds one thousand but does not exceed five thousand gallons	12	*plus* Rs. 2 for every one thousand gallons, or part thereof, in excess of one thousand gallons.
where the quantity exceeds five thousand but does not exceed fifty thousand gallons	20	*plus* Rs. 4 for every one thousand gallons, or part thereof, in excess of five thousand gallons.
where the quantity exceeds fifty thousand gallons ...	250	
Special licenses to transport dangerous petroleum—		
where the quantity does not exceed forty gallons ...	2	
where the quantity exceeds forty gallons but does not exceed four hundred and eighty gallons	2	*plus* As. 8 for every forty gallons, or part thereof, in excess of forty gallons.
where the quantity exceeds four hundred and eighty gallons	8	*plus* Rs. 2 for every four hundred and eighty gallons, or part thereof, in excess of four hundred and eighty gallons.
General licenses to transport dangerous petroleum	100	
The fee for General licenses in Form J is	5	

SOME BOMBAY MOTOR CAR COMPANIES.

I would remind my readers that these pages are the work of an Amateur—a soldier who has had neither the time nor the opportunities to enable him to become personally acquainted with a large number of Motor Firms—and that this book, admittedly far from complete, has been written with the honest endeavour of assisting those who, with little or no previous knowledge of the subject, are thinking of taking up motoring in India.

My publishers, to whom I am already deeply indebted for help and advice, consider that a descriptive list of all the motor firms in India would form more appropriate and useful matter for this chapter. Doubtless they are right, but my endeavours to obtain the necessary information, by means of advertisements, in the Indian daily papers, met with such poor response from the trade, that I am obliged for the present to limit the list to those firms in Bombay with whom I have had personal dealings and whom I can in consequence recommend. The firms mentioned have given me every facility of examining their workshops, business premises and the mechanical details of their cars.

I mention only three Bombay Motor Car Companies, namely : –

(1) The Western India Motor Company.

(2) The K. and S. Cycle and Motor Company.

(3) Messrs. Hill Sawyer and Company.

There are several other firms in Bombay and in other parts of India, carrying on the same business ; some of them, such as the Bombay Motor Car Company, being very widely known throughout the country.

THE WESTERN INDIA MOTOR COMPANY.

This firm, probably, possesses the most up to date motor workshop in India. They are agents for several well known cars such as the Swift, Thornycroft, Beaufort, Orleans, Cottereau, Clement, and Vauxhall. They stock a very complete range of motor accessories and their prices compare most favourably with other Indian firms. The following list gives the prices of some of the cars sold by this Company, and my readers will be able to judge of the appearance of each car by means of the accompanying illustrations.

22 H.-P.—4	cylinder	Orleans ...	plate	**A**	Rs.	10,000
40-50 H.-P.—4	,,	Beaufort.			,,	15,000
18-22 H.-P.—4	,,	Beaufort-Princess.	,,	**C**	,,	10,000
10 H.-P.—2	,,	Beaufort.	,,	**D**	,,	5,500
15-18 H.-P.—3	,,	Cottereau	,,	**E**	,,	7,000
12-14 H.-P.—3	,,	Vauxhall	,,	**F**	,,	6,400

These are all pleasure cars. The Company, however, also deals in business cars, a branch of the trade which has an important future before it, although at present it is making headway very slowly. The following illustrations may be of interest :—

24 H.P.—4 cylinder, double decked Thornycroft Omnibus, Plate **G**	Rs. 17,000
24 H.P.—4 cylinder, single decked Thornycroft Omnibus, Plate **H**	Rs. 16,000
24 H.P.—4 cylinder, Thornycroft 3-ton wagon, Plate **I** ...	Rs. 10,000
3 to 3½ ton Thornycroft Steam Lorry...	Rs. 11,000

The Company is willing to defray half the packing and shipping charges of their cars to Bombay to purchasers of this book, *vide* concession form at the end. This offer to hold good for one year from the date of publication of this volume.

Address—

THE WESTERN INDIA MOTOR CO.,

RAMPART ROW, BOMBAY.

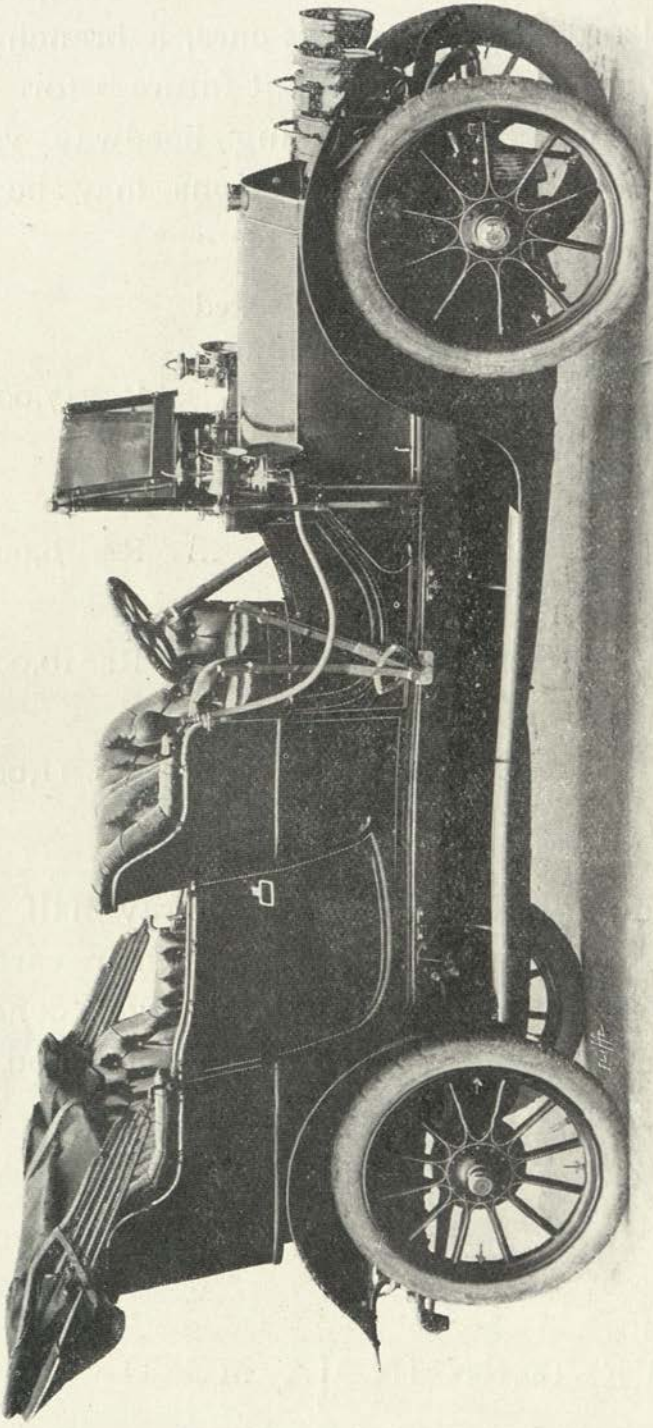


Plate A.

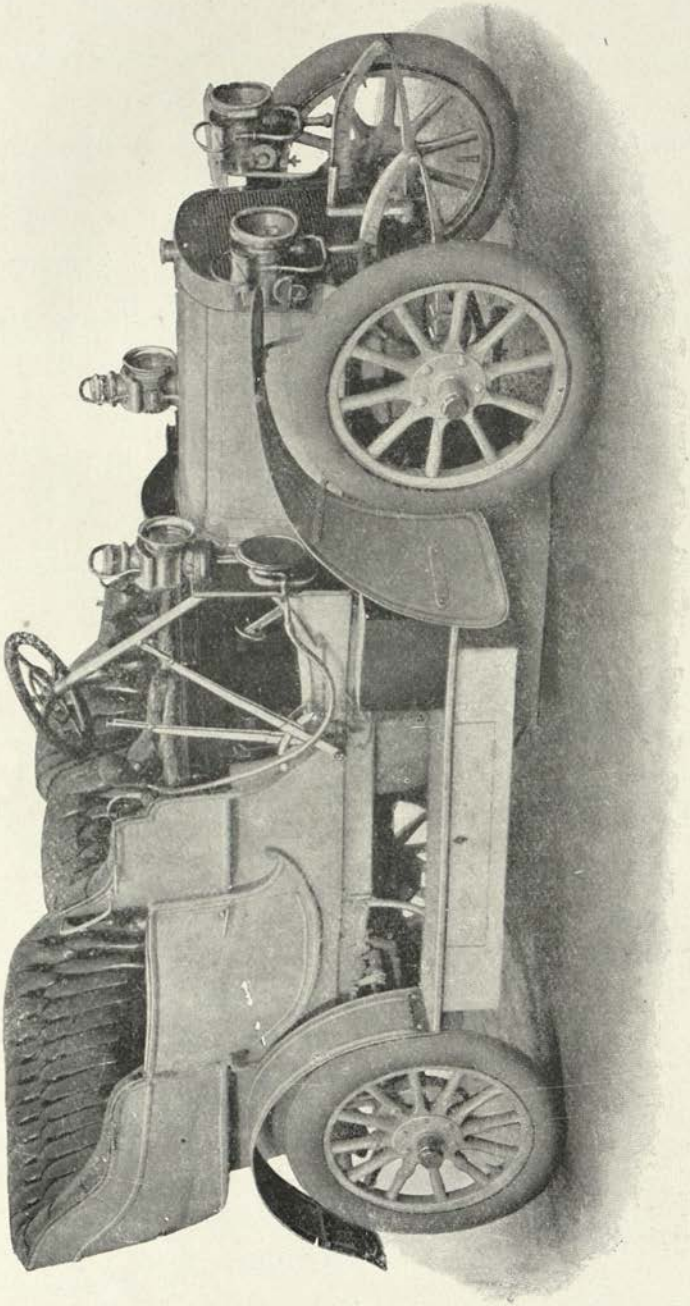
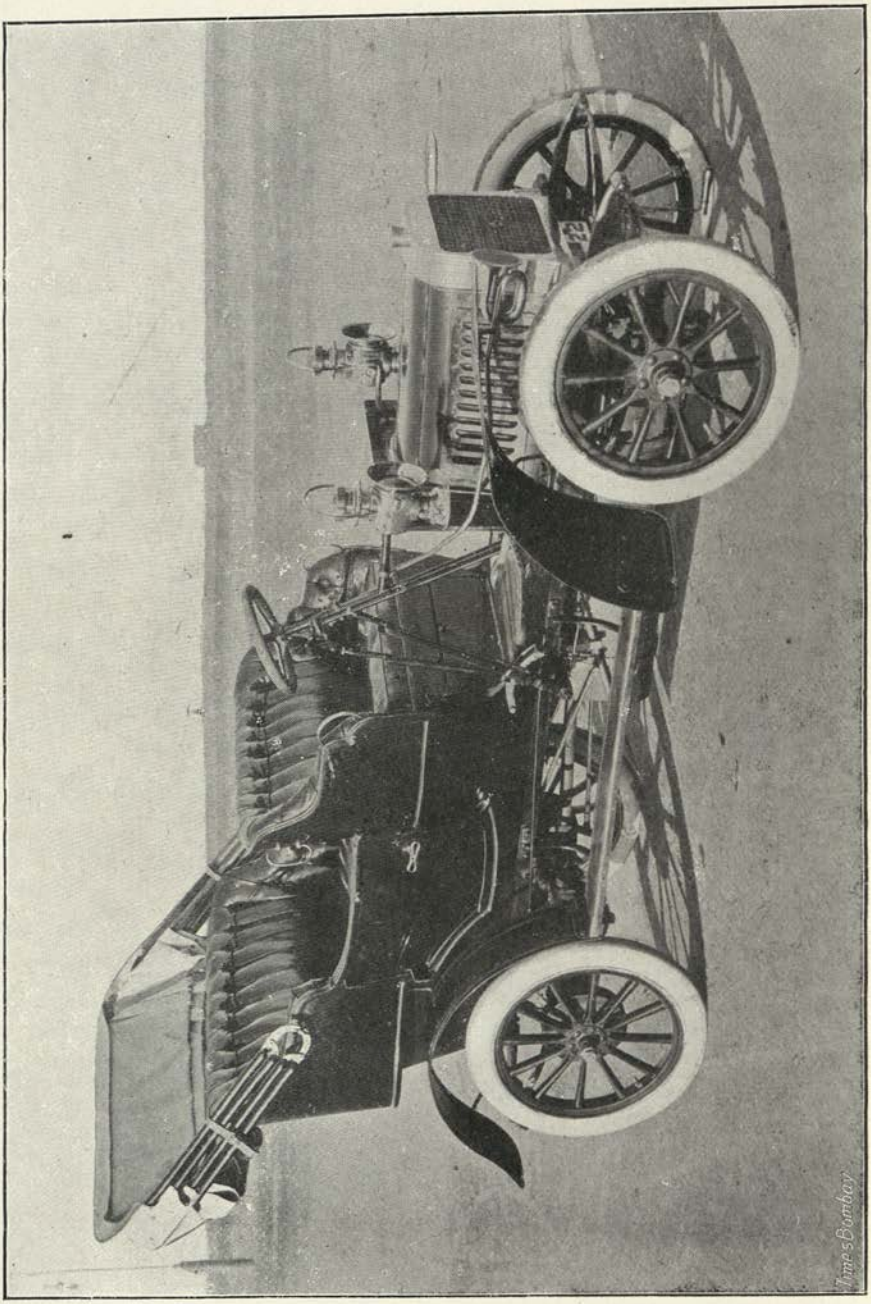


Plate C.



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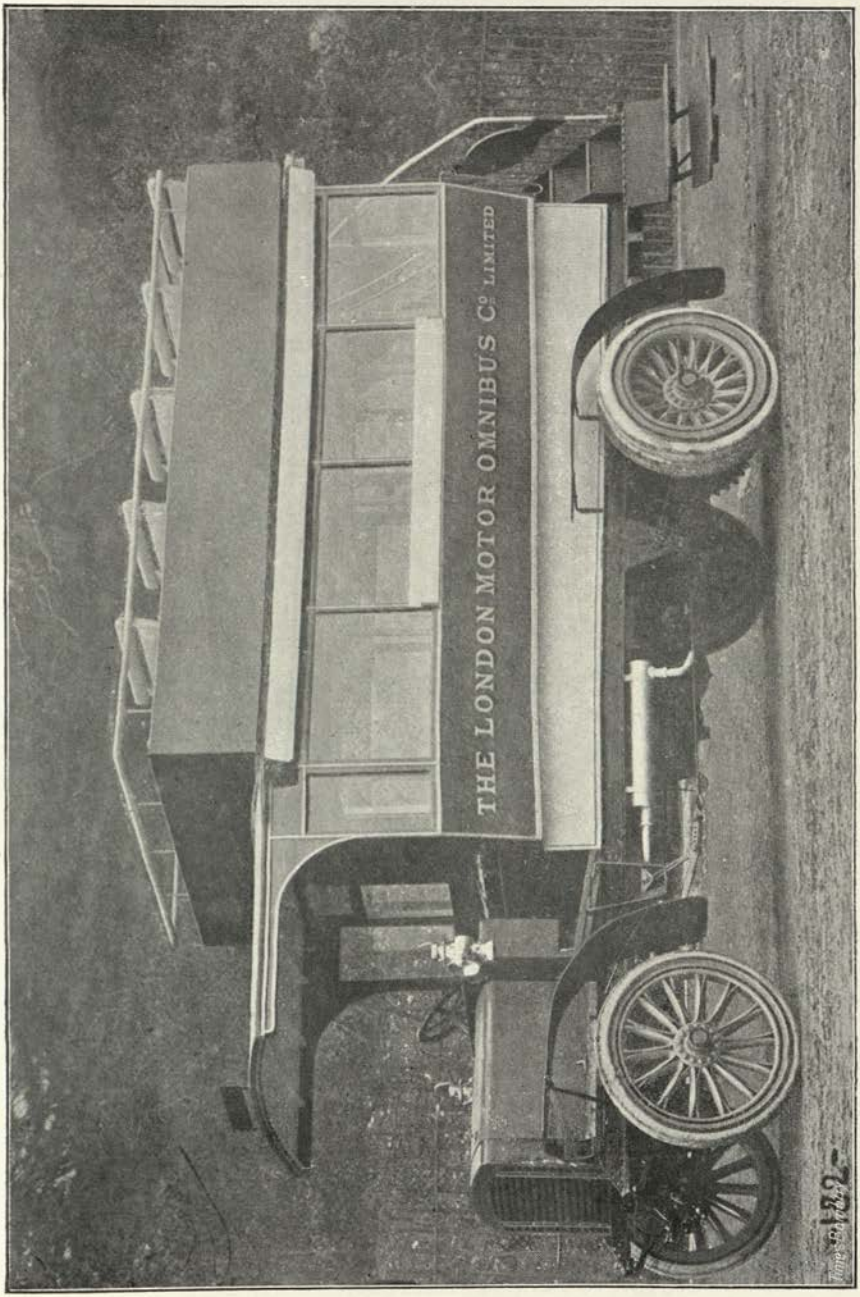


Plate G.

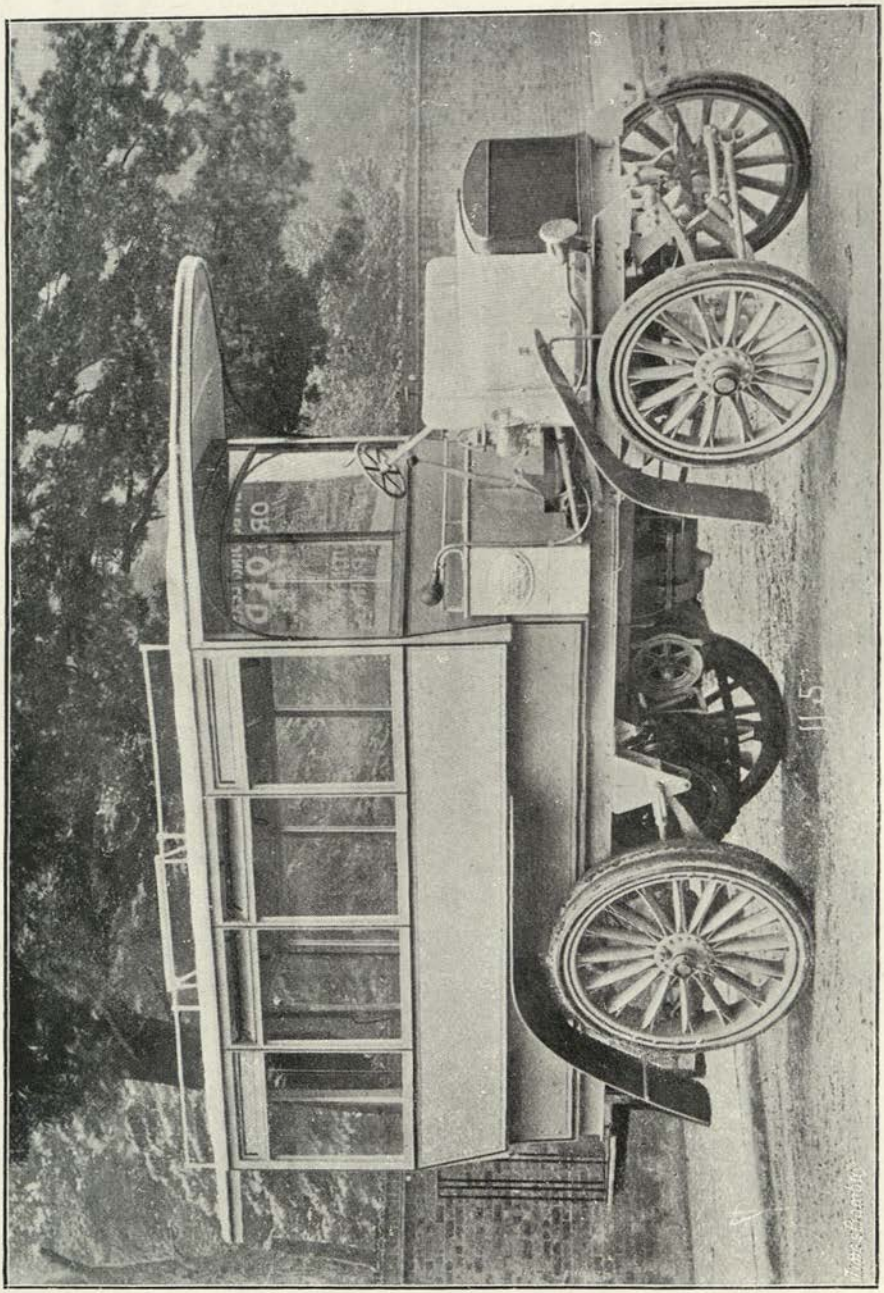


Plate H.

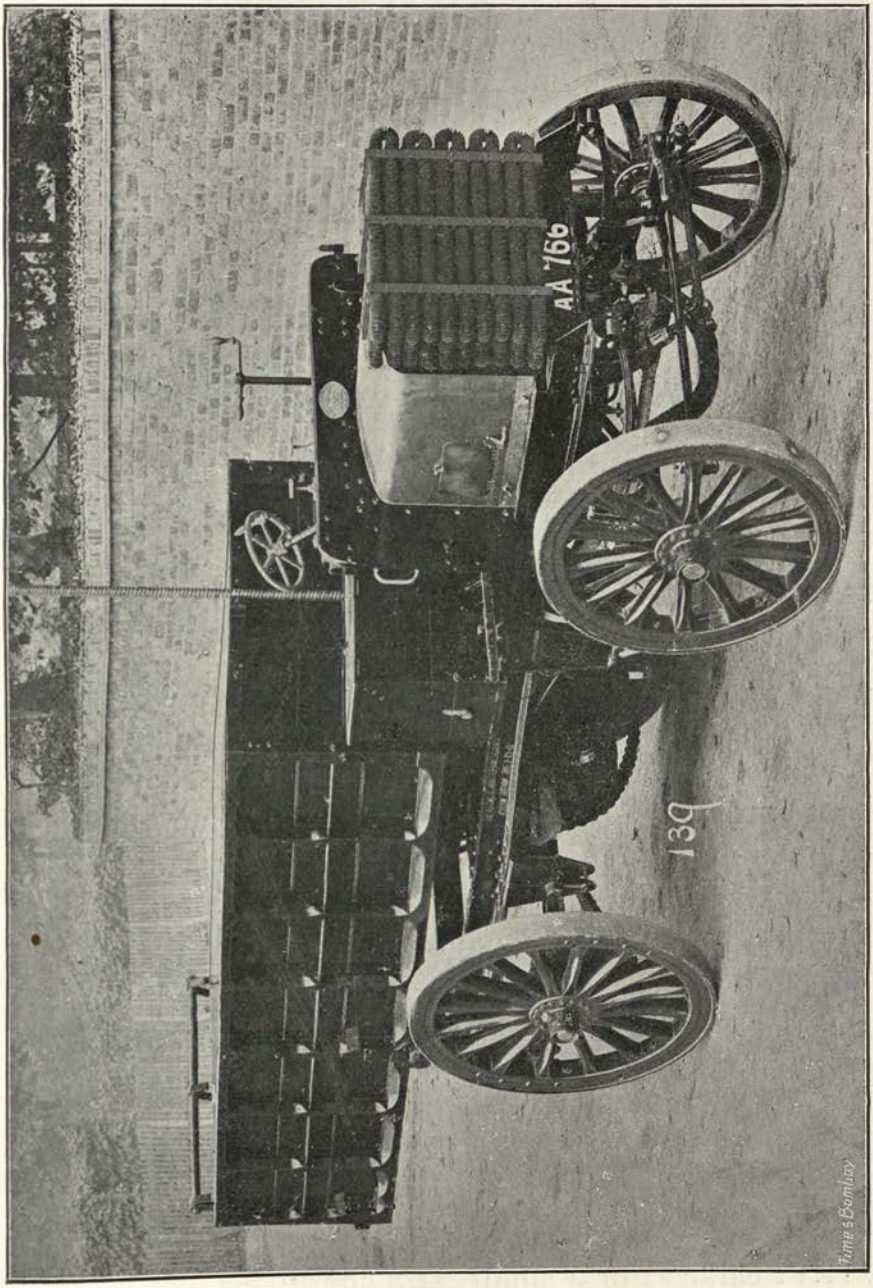


Plate I.

The K. & S. Cycle and Motor Co.

This firm is partly owned, and entirely managed, by Mr. Lalkaka, one of the most obliging men with whom I have ever had to do business. As the Bombay Agents for Wolseley and Siddeley Machines, this Motor Company sells a large number of cars, ranging from the tiny 6 H.P. run-about to the powerful 70 H.P. Racer.

The Wolseley is very well known in India, but the Siddeley, which is built by the same makers (and is, of the two, the more popular car in England) has not yet been put on the Indian Market. Several of the 15 H.P. and 18 H.P. models are, however, on their way out, and I have no doubt they will be eagerly bought up by those who require a strongly built and moderately priced car of the Horse Power mentioned.

The 12 H.P. Siddeley is a most excellent 2-cylindered car, and it is a pity that they are not imported into the country, as, in my opinion, a good 2-cylindered car is the best for a beginner to learn on, especially if he does not intend keeping a competent chauffeur.

The Engines are of the vertical type—2 cylinders in the case of the 12 H.P. and 4 cylinders in the higher powered models. The frames are constructed of pressed steel, the ignition by accumulator and high tension coil in 12 H.P. cars, by high tension magneto in 15 H.P. and 18 H.P. cars, and low tension magneto in the 25 H.P., 32 H.P. and 70 H.P. cars. For a small extra charge accumulator ignition can be added to the magneto ignition.

The lubrication is insured by means of a mechanically driven pump, the quantity of oil used being in proportion to the engine speed.

The lift of the inlet valves can be regulated by the driver, by means of a lever mounted on the steering wheel. The clutch is leather-faced, fitted with springs so as to ease the strain if the clutch is accidentally "let in" too sharply. The gear wheels are of steel, case hardened by a special process.

The 12 H.P. and 15 H.P. cars are gear driven, the more powerful models being chain driven.

All brakes are of the metal to metal type. The foot brake acting on the propeller shaft, and the hand brakes operating inside drums on the driving wheels.

This brief description will shew the reader that the Wolseley and Siddeley cars differ essentially in mechanical details.

The following are the rates at present charged for petrol by the K. & S. Cycle Motor Company :—

Pratt's Petrol	...	... Re. 1 per gallon.
Shell or Asiatic	...	... As. 14 ,,
Burma ...	...	... ,, 11 ,,

The address is—

K. & S. CYCLE AND MOTOR CO.,

TARDEO, BOMBAY.

Telegraphic Address—

CYCLES, BOMBAY.

Messrs. Hill Sawyer & Co.

Mr. Sawyer drove a 12 H.-P. Darracq from Delhi to Bombay during the 1904 trials without the loss of a single mark. This performance not only proved the reliability of the car, but also proved Mr. Sawyer, who tuned the car up, and attended to it, without assistance, all through the trials, to be thoroughly competent.

I do not intend giving a detailed description of the Darracq, but will merely touch on two out of many interesting features, *viz.*:—

(1) *The clutch.* This is a leather-faced friction clutch. The essential detail in which this differs from the usual type of leather-faced is the provision of internal springs. These spiral springs, which lie parallel to the face of the clutch, form a spring buffer between the male portion of the clutch and the clutch shaft. Even if it is let in with a bang, the elasticity of these springs almost entirely absorbs the shock, and if the clutch is properly used, the strain on the mechanism is practically nil, and the drive is taken up very sweetly.

(2) The change speed pinions are each mounted on a separate section of the shaft, so that, in case of one or more pinions becoming damaged, the damaged pinion, or pinions, can be quickly and easily removed, and new pinions mounted on similar sections of the shaft, dropped into the

vacant space, or spaces; the whole operation is very simple.

Darracqs are built in several standard models :—

8	H. P.	Single	Cylinder	...	Plate **K**.	Rs.	3,500
10	H. P.	2	,, ...	...		Rs.	4,700
15	H. P.	4	,, ...	...	Plate **L**.	Rs.	7,500
20-32	H. P.	4	,, ...	...	Plate **M**.	Rs.	9,500
40	H. P.	4	,, ...	...		Rs.	14,600
70	H. P.	4	,, ...	...		Rs.	20,500
15	H. P.	4	,,	Landaulette		Rs.	10,000

Mr. Sawyer has also secured the Agency for the Horbick. This is an English car built by Messrs. Horsfall and Bickham of Manchester. It is a handsome car, remarkable for its smooth and quiet running, and it is very popular in the Manchester and Liverpool districts. Four standard models are built, *viz.* :—

10-12	H. P.	3	Cylinder	...	... ...	Rs.	5,450
12-16	H. P.	4	,,	...	... ...	Rs.	5,800
15-20	H. P.	4	,,	...	Plate **O**.	Rs.	8,800
20-24	H. P.	4	,,	...	... ...	Rs.	10,650

Address—

MESSRS. HILL SAWYER & Co.,
MEADOWS STREET, BOMBAY.

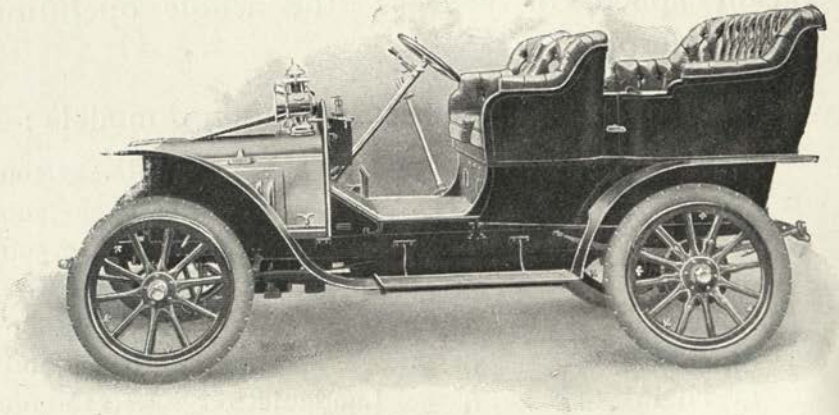


Plate K.

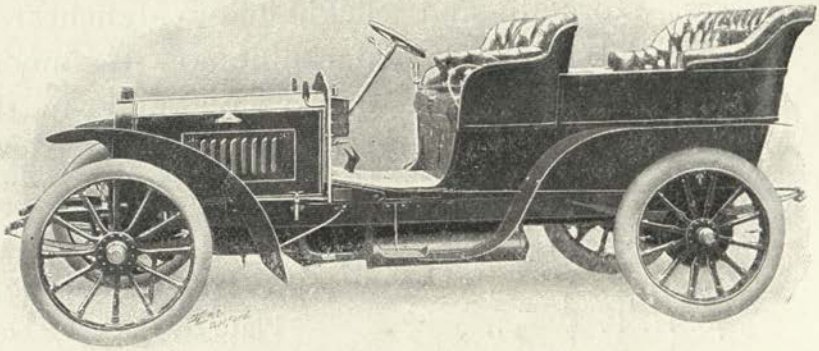


Plate L.

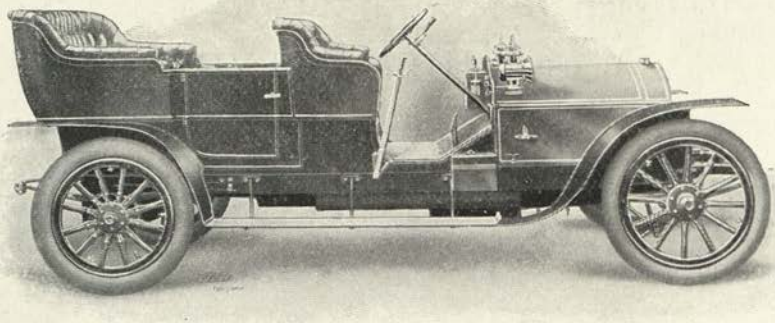


Plate M.

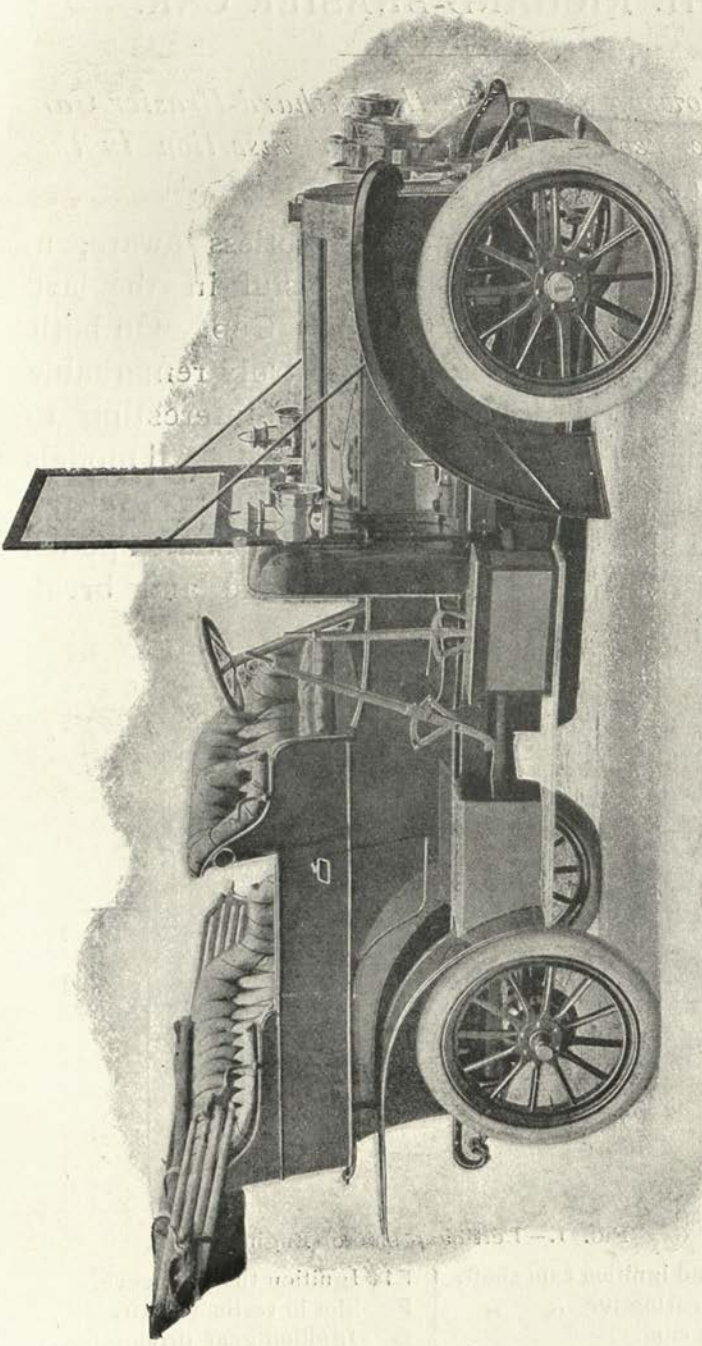


Plate O.

THE RICHARD-BRASIER CAR.

The following details of the Richard-Brasier Car were received too late for insertion in the body of the book:—

Most of my readers are doubtless aware, a Richard-Brasier car was successful in the last two races for the Gordon-Bennett Cup. On both these occasions the cars ran with truly remarkable regularity. It will therefore be interesting to notice some of the details of these cars. All models are driven by four-cylinder engines having, on the left hand side, the magneto and the shaft operating the overhead horizontal make and break shaft (Fig. 1).

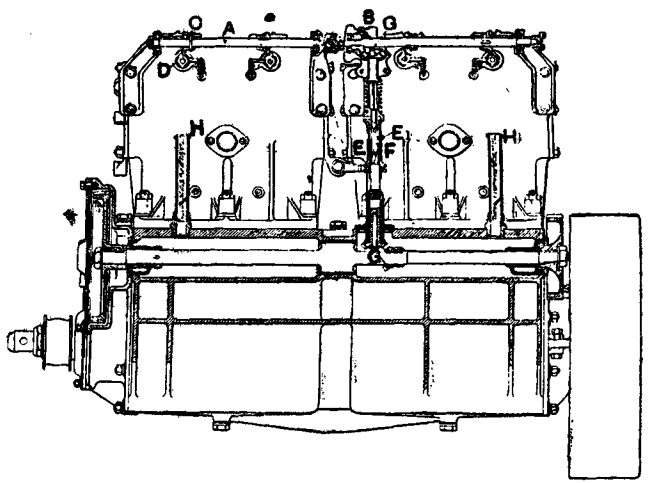


FIG. 1.—Left hand side of Engine.

A Overhead ignition cam shaft.
B Bevel gearing for ,, ,,
C Ignition cam.
D ,, tappet.
E ,, timing lever.
E1 Ignition timing sleeve.
F Slot in vertical shaft.
G Ignition gear driving bevel.
H H Air vents to crank chamber

The carburetter and all the exhaust and inlet pipes are on the right hand side of the engine (Fig. 2).

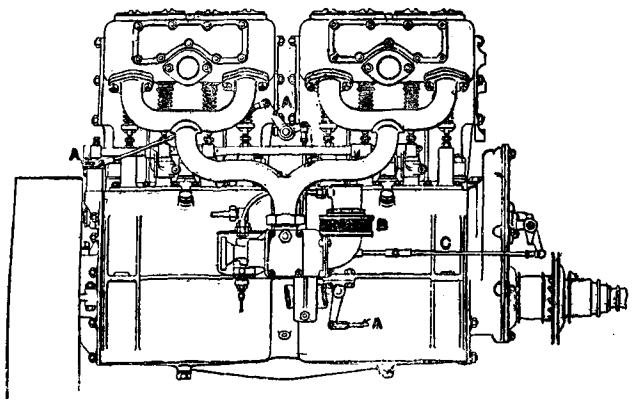


FIG. 2.—Right hand side of Engine.

A Compression relief rod.
B Extra air chamber.
C Connecting rod between governor and throttle valve.

These valves are effectively cooled by being surrounded by the water jacket, as will be seen in Fig. 3. A study of this last figure discloses the following notable features :—

(*a*) The exceptional length of the pistons, which minimises the risk of lubricating oil finding its way into the combustion chambers, and also provides large wearing surfaces.

(*b*) The great distance allowed between the piston-crown and the small end bearing, which assists to keep the latter cool.

(*c*) The placing of the piston and crank shaft slightly "out of line", so that on the explosion stroke the thrust is, as nearly as possible, parallel with the cylinder walls, thereby minimizing friction.

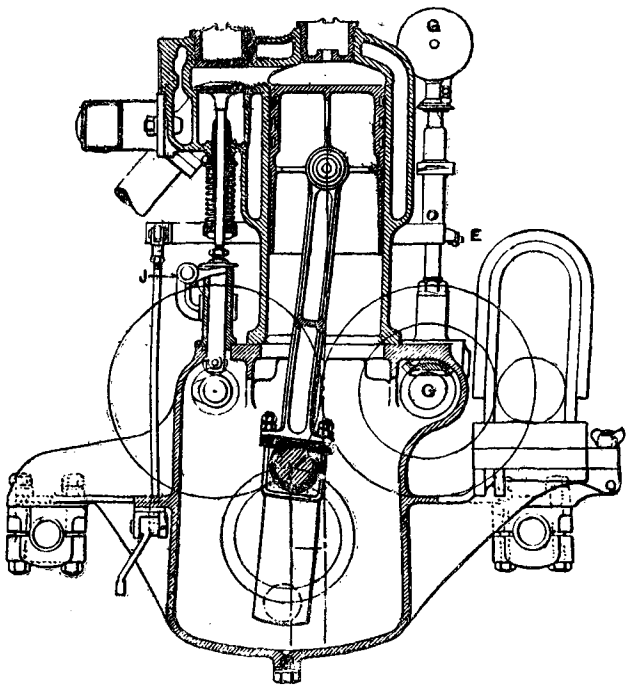


FIG. 3.

E Ignition timing lever.
G G Bevel gears for ignition.
J Compression lever.

(*d*) The unusually deep and narrow crank chamber.

Fig. 4 shows the automatic carburetter in section. The peculiarity here is the provision of the piston H.

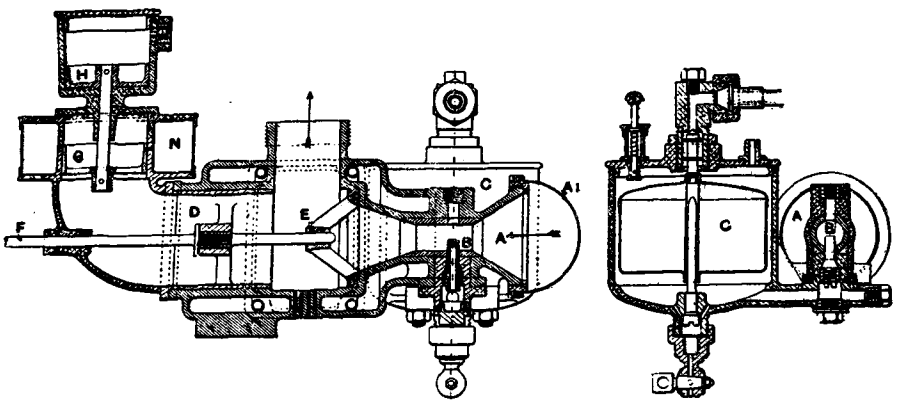


FIG. 4.

- **A** Air intake.
- **A1** Gauze cover to air intake.
- **B** Petrol jet.
- **C** Float.
- **D** Piston throttle valve.
- **E** Guide to throttle valve rod.
- **F** Throttle valve rod.
- **G** Extra air inlet valve
- **H** Vacuum piston actuating extra air inlet valve.

The peculiarity here is the provision of the piston H. In Fig. 4 two joints will be seen,—one immediately above the jet B and the other to the right of the piston H. A pipe connects these joints, by which the suction of the engine is also communicated to the piston H. The more powerful the suction the higher the piston rises, carrying with it the valve G. As G rises the size of the opening into the extra air intake pipe N increases, the quality of the mixture passing to the engine is thus automatically regulated. The quantity of mixture depends on the position

of the piston throttle valve D, which in its turn is controlled by the driver or the governor.

The engine is cooled on the thermo-syphon system. The water tank is placed well above the level of the cylinders, and the connections are large, so as long as there is a sufficiency of water overheating is impossible.

The clutch, transmission system, lubricating system, &c., &c., are all thoroughly up to date.

These cars are sold in Bombay by the Paris-India Company of Hornby Road. This firm, though only lately established in India, seem to be doing plenty of business. Being under able management and having an adequate staff of trained mechanics they should do well, considering how rapidly the numbers of motorists are increasing all over the country.

ROAD MAPS.

ROAD MAPS.

Considerable difficulty has been experienced in compiling the following maps and reports, in spite of the kindness of several of the Engineers in charge of sections and districts.

A more complete collection of these maps would be of great value to motorists in India. I propose, therefore, to publish a second series, if those interested in motoring will follow Mr. Scovell's example by supplying me with maps and descriptions of the roads with which they are acquainted.

Communications to be addressed to :—

MAJOR D. WARREN,
c/o THE MANAGER,
Times of India, Bombay.

MAP 1.

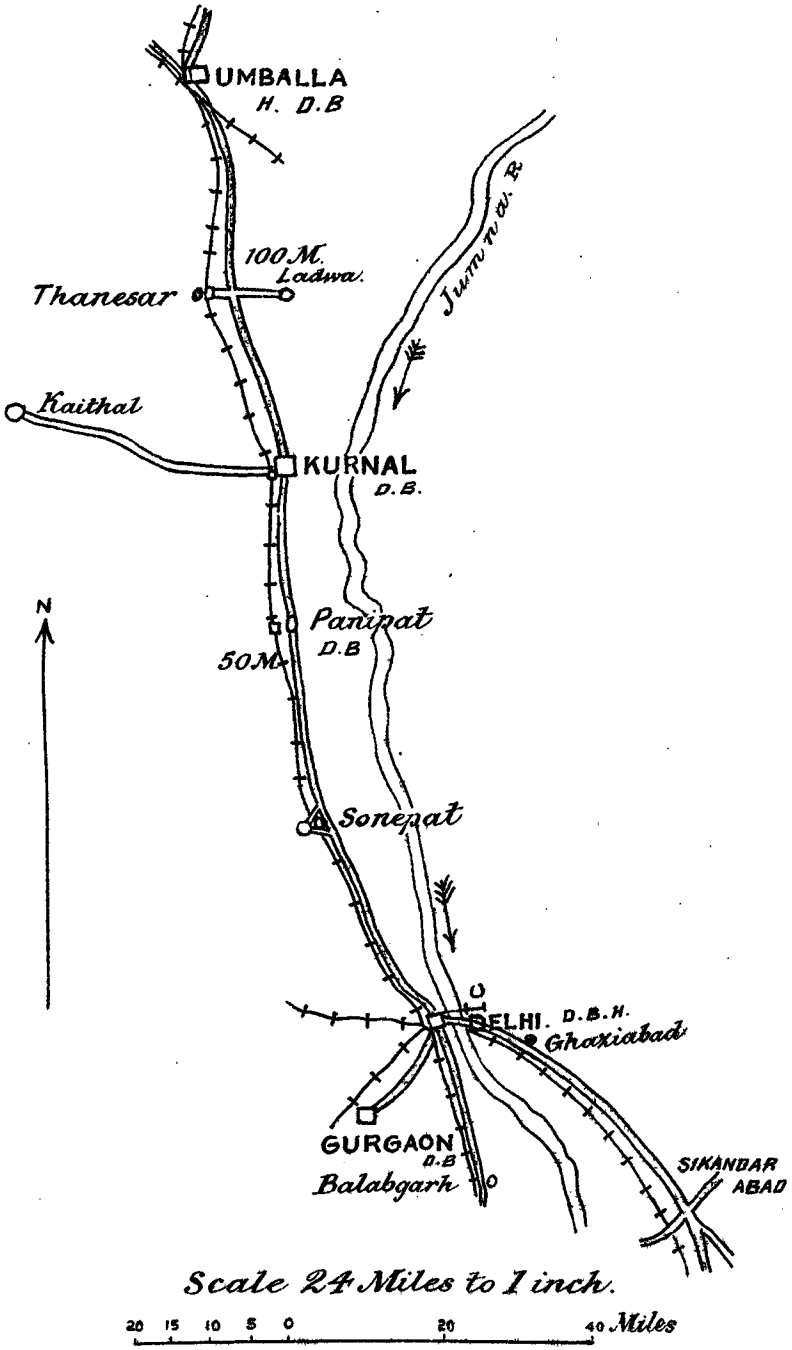
Delhi to Umballa—126 Miles.

Delhi to Sonepat ... ... 29 *Miles.*
Good level road.

Sonepat to Panipat ... ... 25 *Miles.*
Good level road.

Panipat to Kurnal ... ... 20 *Miles.*
Good level road.

Kurnal to Umballa ... ... 52 *Miles.*
Good level road.


UMBALLA
H. D.B
100 M.
Ladwa.
Thanesar
Jumna R.
Kaithal
KURNAL
D.B.
N
Panipat
D.B
50 M.
Sonepat
DELHI. D.B.H.
Ghaziabad
GURGAON
D.B
Balabgarh
SIKANDAR
ABAD
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 Miles

MAP 2.

Umballa to Lahore { 191 Miles. or 188 „

Umballa to Ludhiana ... ... 65 *Miles.*

Good level road.

Via *Ferozepur.*

Ludhiana to Dagru ... 49 *Miles.*

Level road, dak bungalows at Jagraon and Dagru.

Dagru to Ferozepur ... 27 *Miles.*

Good road.

Ferozepur to Lahore ... 50 *Miles.*

Six miles north of Ferozepur the Sutlej is crossed by a magnificent road and railway bridge.

Total ... 191 Miles.

Via *Jullundur.*

Ludhiana to Jullundur . 38 *Miles.*

Good roads; level crossings should be taken carefully.

Jullundur to Amritsar .. 49 *Miles.*

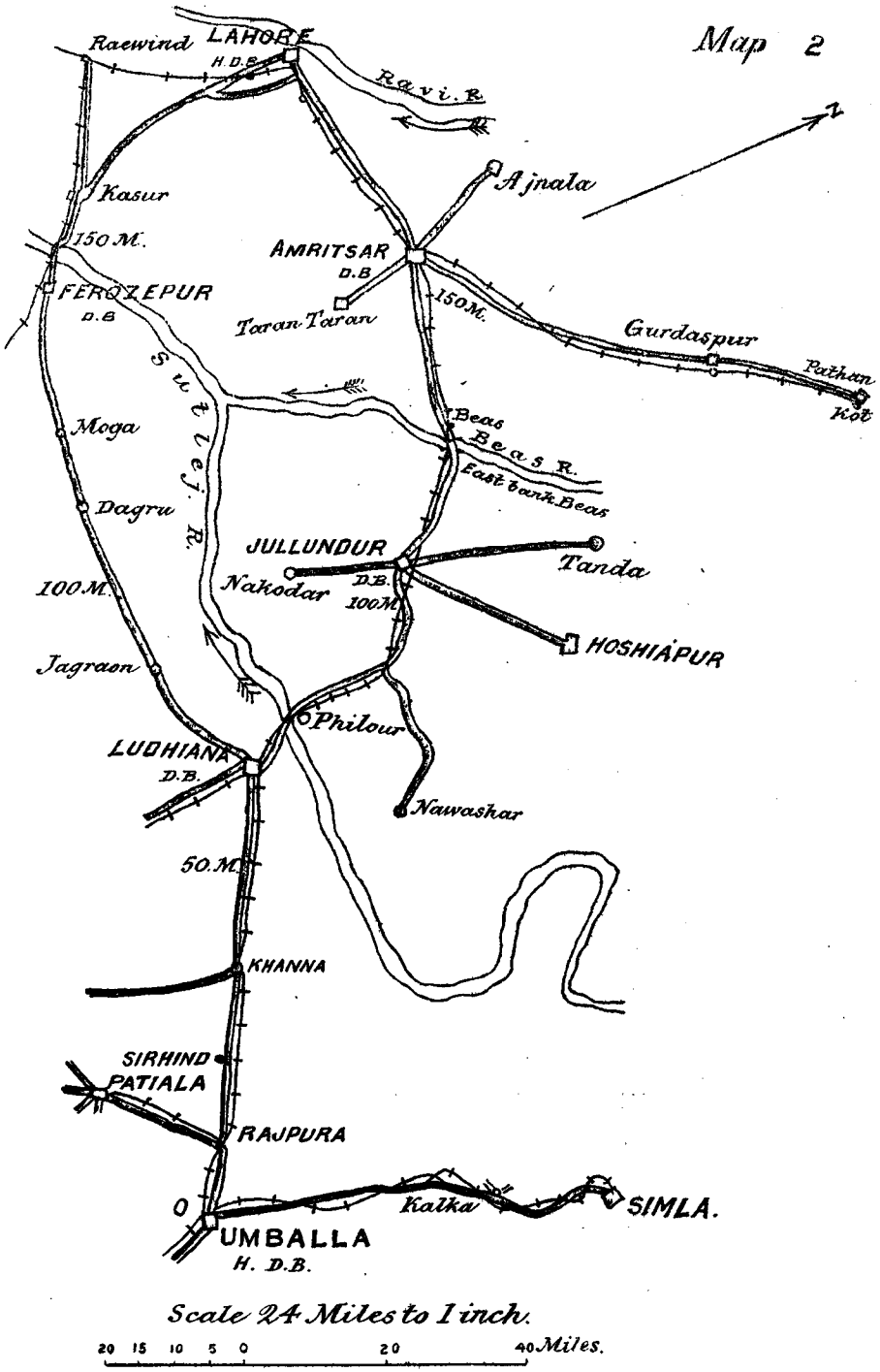
Twenty-three miles north of Jullundur the Beas River has to be crossed. There is no road bridge and no ferry train. Arrangements for a truck must be made beforehand by writing to the District Traffic Superintendent, N.-W. Railway, Lahore. The charges are between Beas and East Bank Beas :—

Rs. 3-12-0 at railway risk.

Rs. 1-14-0 at owner's risk.

Amritsar to Lahore .. 36 *Miles.*

Total ... 188 Miles.


Map 2
Raewind
LAHORE
H.D.B.
Ravi R.
Ajnala
Kasur
150 M.
AMRITSAR
D.B
FEROZEPUR
D.B
Taran Taran
150M.
Gurdaspur
Pathan Kot
Sutlej R.
Beas
Beas R.
East bank Beas
Moga
Dagru
JULLUNDUR
D.B.
Tanda
100 M.
Nakodar
100M.
HOSHIAPUR
Jagraon
Philour
LUDHIANA
D.B.
Nawashar
50.M.
KHANNA
SIRHIND
PATIALA
RAJPURA
Kalka
SIMLA.
UMBALLA
H. D.B.
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 Miles.

Map 3.

Lahore to Rawalpindi—175 Miles.

Lahore to Gujranwalla ... ... 40 *Miles.*

On leaving Lahore bear to the right and cross the Ravi by the railway bridge, re-joining the main road a few hundred yards north of the river. A good level road the rest of the distance.

Gujranwalla to Wazirabad ... ... 20 *Miles.*

Good level, straight road.

Wazirabad to Kathala ... ... 4 *Miles.*

Car must be entrained. Ferry train

leaves Wazirabad 11-32, arrives Kathala 11-54

,, Kathala 13-10 ,, Wazirabad 13-32

Car fare at Owner's risk Rs. 1-14-0

,, ,, ,, Railway risk ,, 3-12-0

Kathala to Jhelum ... ... 37 *Miles.*

Good level road.

Jhelum to Rawal Pindi ... ... 74 *Miles.*

Perfect motoring road, winding through low hills, ascending and descending in wide sweeping curves and by easy gradients. The approach to the Sohan Bridge from Rawal Pindi requires careful driving.

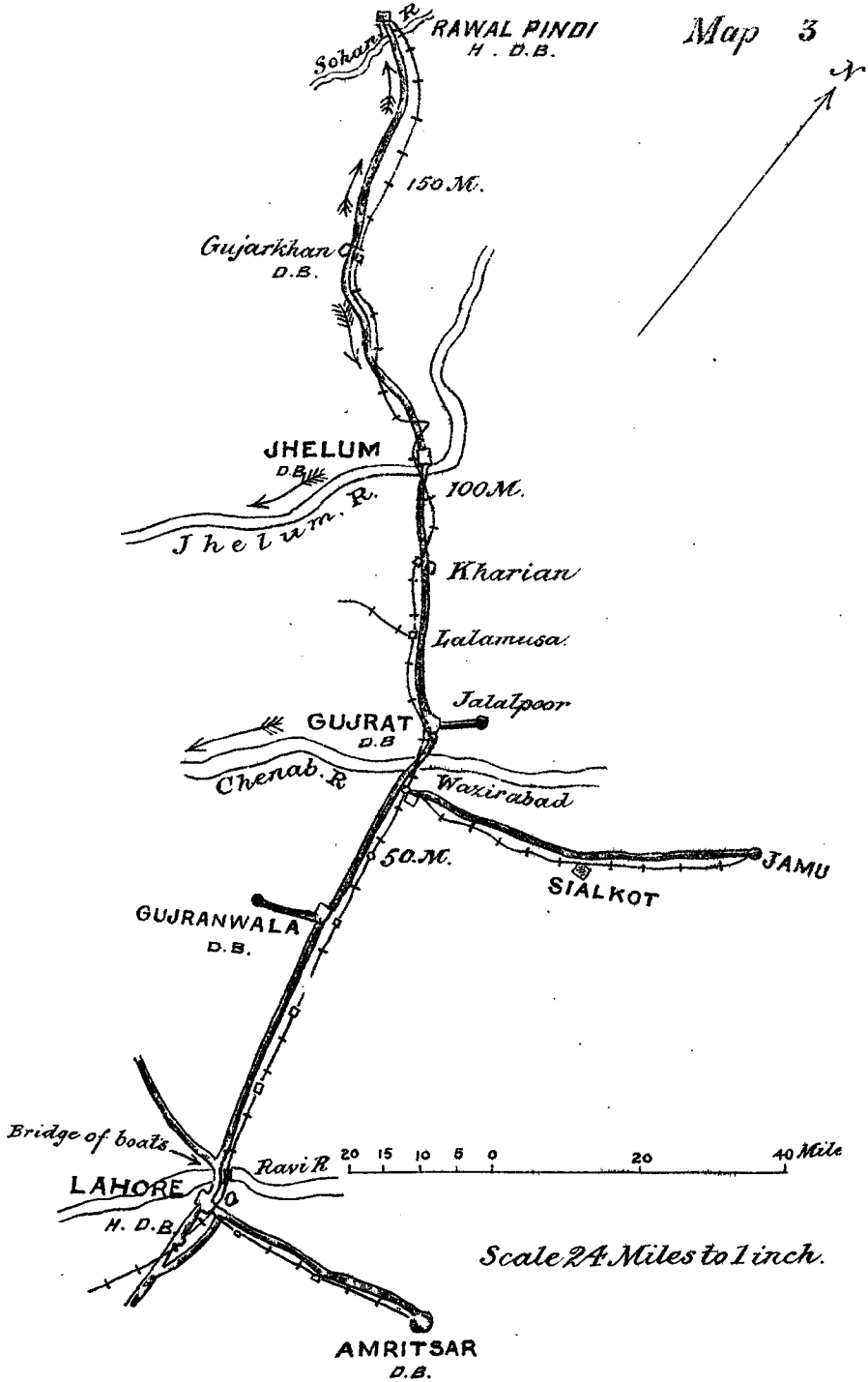
Total ...175 Miles.

Wazirabad to Sialkot ... ... 27 *Miles.*

Good level road, no obstacles.

Sialkot to Jamu ... ... 25 *Miles.*

At present the road is not fit for tourist cars, though passable.


Map 3
RAWAL PINDI
H. D.B.
Sohan R.
150 M.
Gujarkhan
D.B.
JHELUM
D.B.
100 M.
Jhelum R.
Kharian
Lalamusa
Jalalpoor
GUJRAT
D.B.
Chenab R.
Waxirabad
50 M.
JAMU
SIALKOT
GUJRANWALA
D.B.
Bridge of boats
Ravi R.
20 15 10 5 0 20 40 Miles
LAHORE
H. D.B.
Scale 24 Miles to 1 inch.
AMRITSAR
D.B.

Map 4.

Rawal Pindi to Peshawar, etc.

Rawal Pindi to Attock ... ... 55 *Miles.*

Good road. On leaving Pindi there is a long gradual ascent for two or three miles. The Haro River is crossed by the railway bridge. There are several up and down gradients, but none are severe.

Attock to Peshawar ... ... 48 *Miles.*

Good road, practically level. Dak bungalows at Attock, Nowshera and Peshawar.

Peshawar to Landi Kotal ... ... 31 *Miles.*

Road metalled as far as Jamrud, thence mainly unmetalled, but surface good. Worst hill-ascent of 1 in 17 for 1 mile, then 1 in 12 for 200 yards, close to Fort Mande. Be careful not to damage the car on entering the fortified serai at Landi Kotal, as the gate stop projects some inches above the ground. There is a workshop at Landi Kotal, where minor repairs can be carried out. Also a rest-house: permission to use this and other rest-houses must be obtained from the C. R. E., Peshawar.

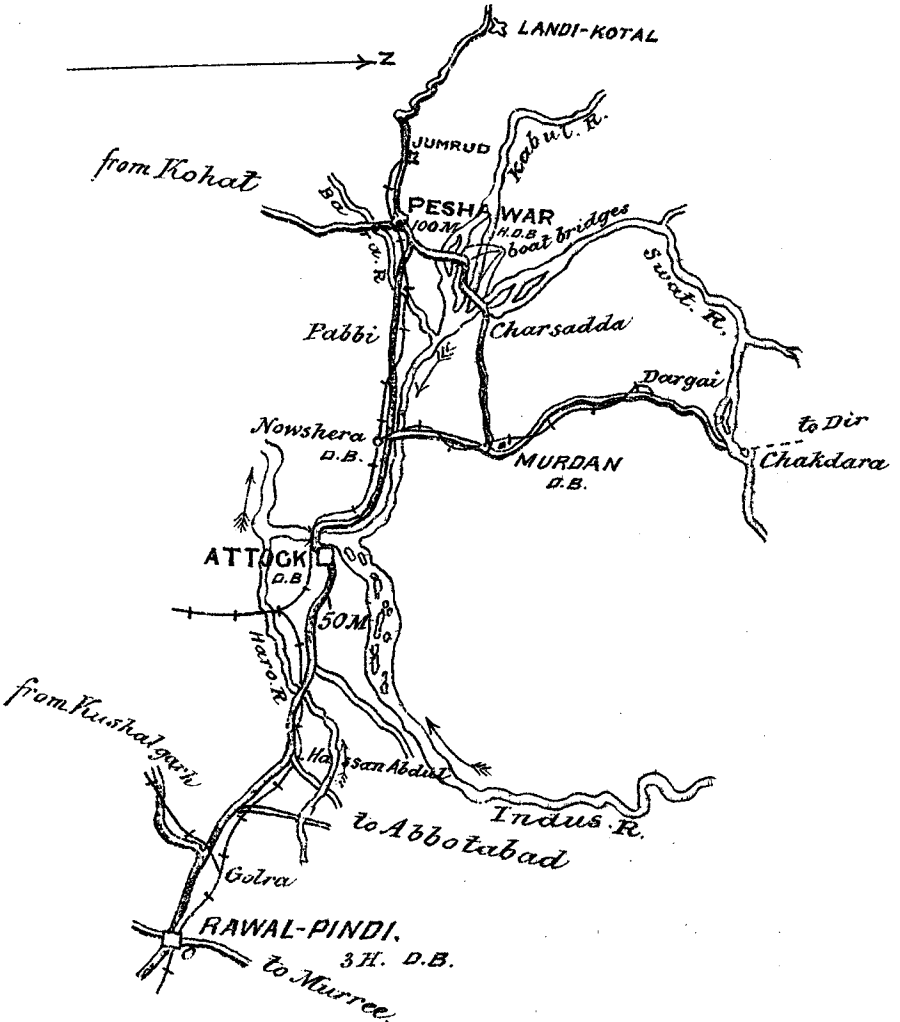
Peshawar to Mardan via *Charsadda* ... *About* 37 *Miles.*

Good, level metalled road as far as Charsadda, 20 miles. Five boat bridges have to be crossed, over which drive slowly. Then 8 miles unmetalled, after which the rest of the road is metalled and flat. There is a furnished rest-house at Mardan, also a dak bungalow.

Nowshera to Chakdarra ... ... 58 *Miles.*

Good, level metalled road as far as Dargai, 41 miles. At Mardan, 15 miles from Nowshera, is a dak bungalow. From Dargai to Malakand the road rises steadily for several miles, it then descends into the valley of the Swat River. The gradient is never more than 1 in 20.

Map 4



20 15 10 5 0 20 40 Miles.

Scale 24 Miles to 1 Inch.

MAP 5.

Delhi to Agra (134) and Dholpur 170 Miles.

Delhi to Sikandarabad ... ... 35 *Miles.*

The Jumna is crossed by the road and rail bridge; careful driving is here necessary, as the approaches to the bridge bend sharply. Good level road.

Sikandarabad to Aligarh ... ... 50 *Miles.*

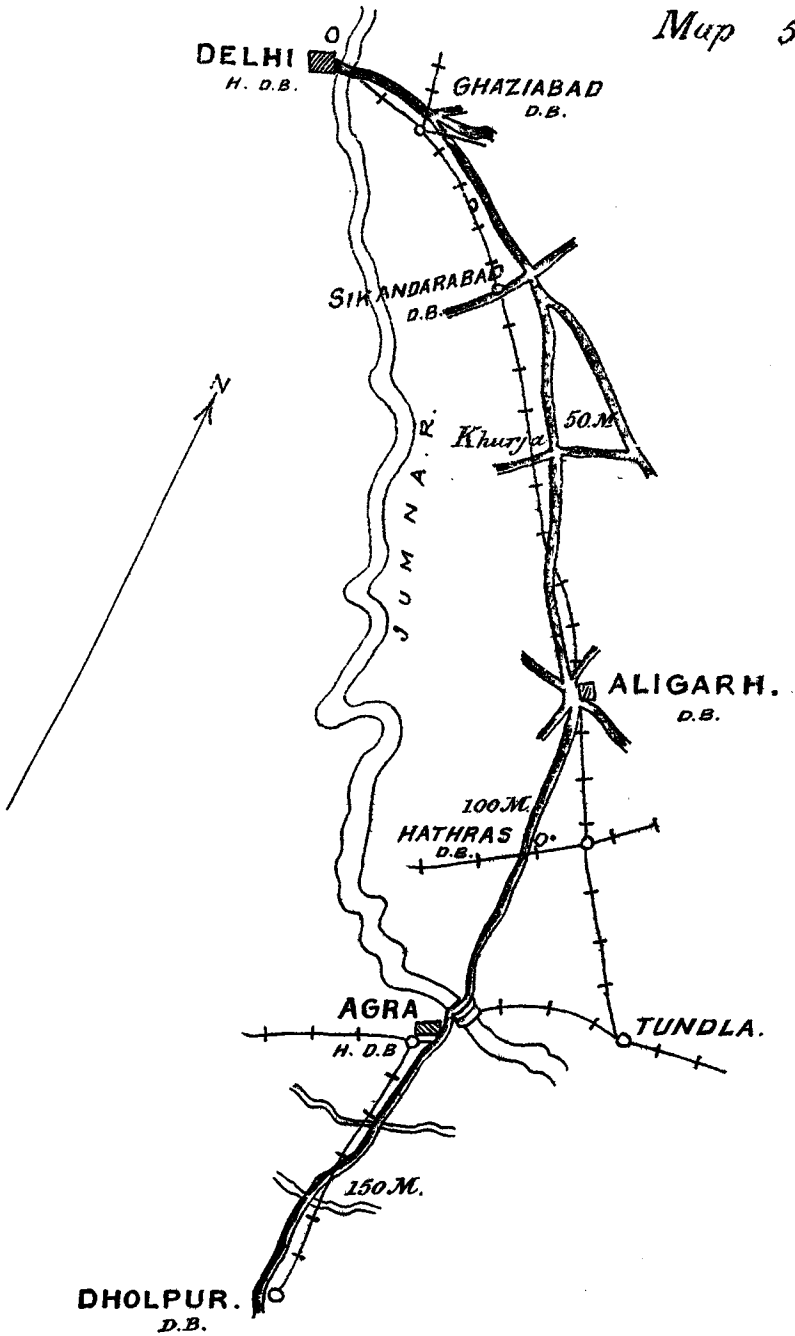
Fairly good road.

Aligarh to Agra ... ... 49 *Miles.*

Good road until nearing Hathras, where careful driving is necessary. Thence to the river the road is good. The Jumna can be crossed either by the railway bridge or by the bridge of boats. In the latter case drive slowly and turn sharp to the left on the Agra side.

Agra to Dholpur ... ... 36 *Miles.*

Very good road, but the railway should be crossed at a moderate pace.



Scale 24 Miles to 1 inch.

20 15 10 5 0 20 40 Miles.

MAP 6.

Dholpur to Goona—170 Miles.

Dholpur to Gwalior ... ... 40 *Miles.*

The Chambul River is crossed on a bridge of boats ; the banks are steep, and careful driving is necessary.

Gwalior to Sipri ... ... 70 *Miles.*

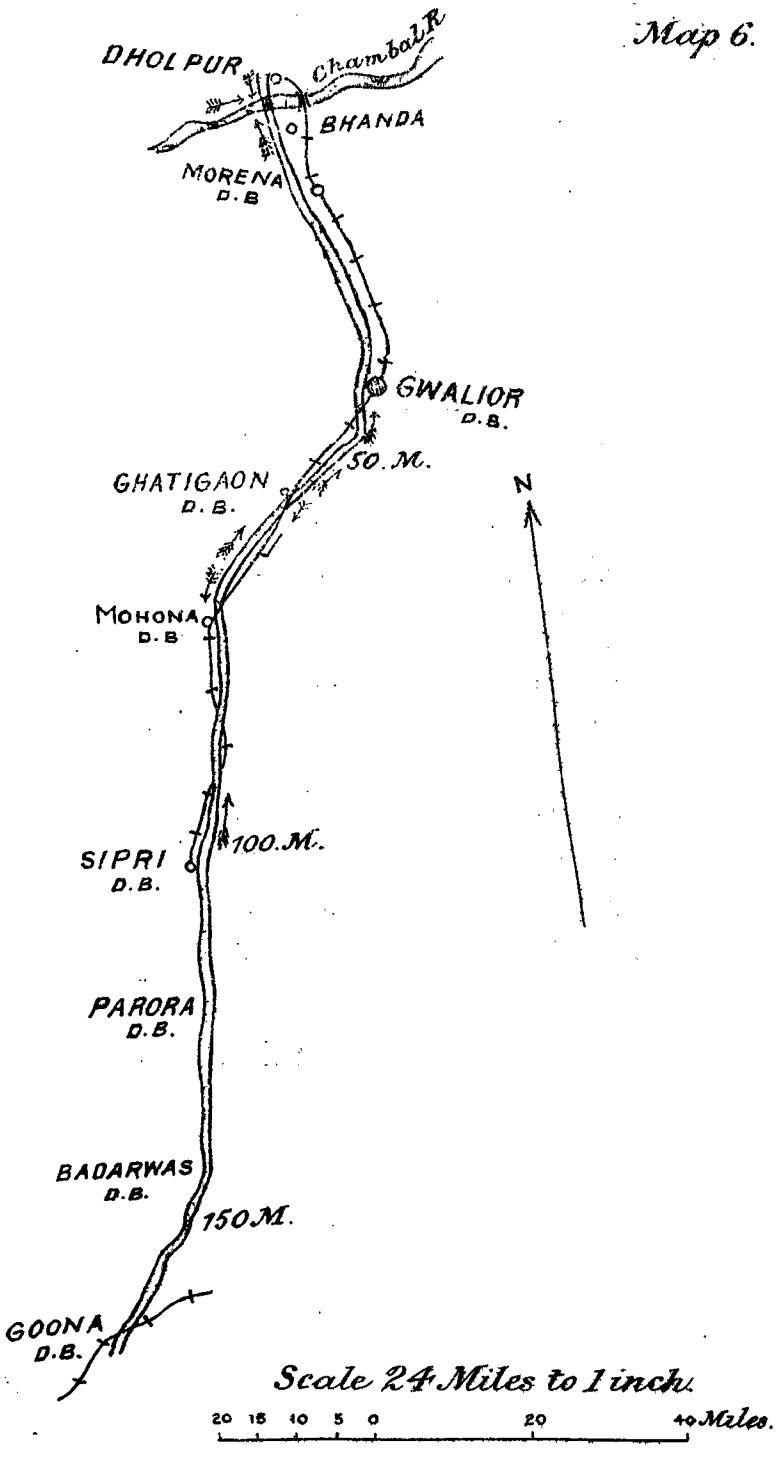
On leaving Gwalior the road for several miles is on a succession of up and down gradients, none very steep. The driver must keep a sharp look-out for Irish bridges. These being in the hollows, the tendency is to take them at high speed. Serious damage to the car may be the result.

Sipri to Goona ... ... 60 *Miles.*

Good, level road.

Total ... 170 Miles.

Map 6.


DHOLPUR
Chambal R
BHANDA
MORENA
D.B
GWALIOR
D.B.
50.M.
GHATIGAON
D.B.
N
MOHONA
D.B
100.M.
SIPRI
D.B.
PARORA
D.B.
BADARWAS
D.B.
150M.
GOONA
D.B.
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 Miles.

Map 7.

Goona to Indore—175 Miles.

Goona to Biaora ... ... 60 *Miles.*

The two rivers shewn on the map are unbridged. When the water is low, cars can cross by the stone causeways. The banks are in both cases very steep. Road generally-bumpy.

Biaora to Maksi ... ... 68 *Miles.*

Level, fairly good road as far as Sarangpur. From Sarangpur to Maksi the road is hilly, but good.

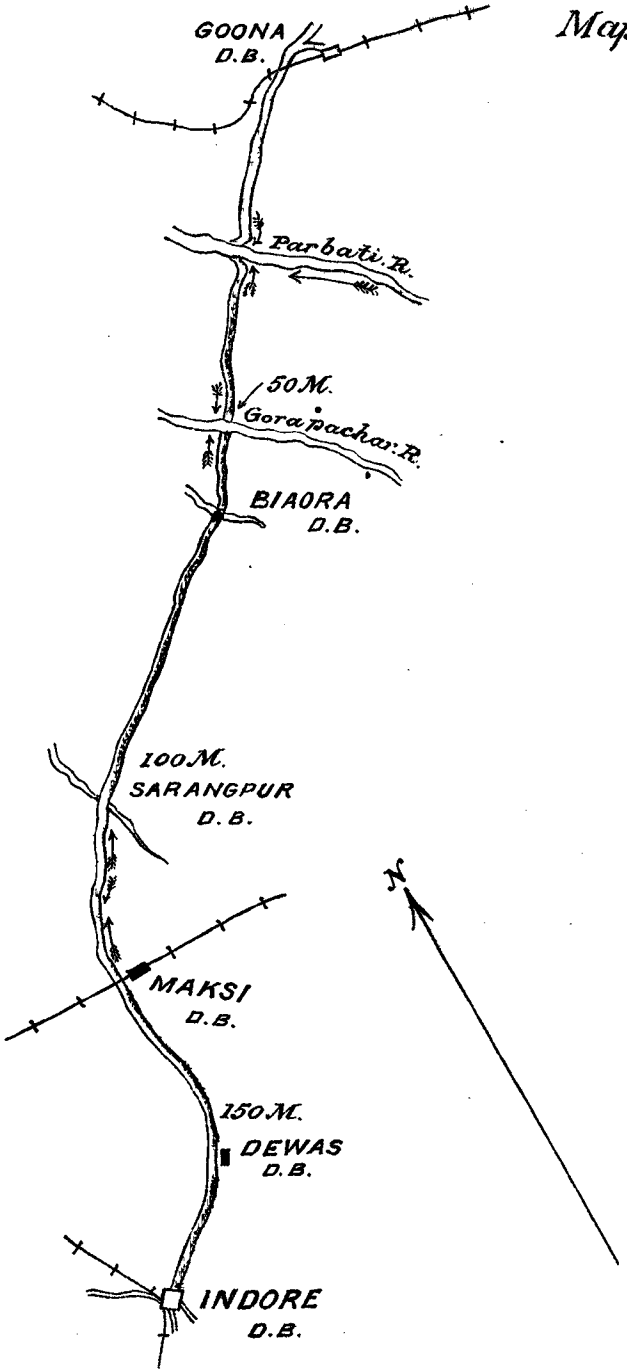
Maksi to Indore ... ... 47 *Miles.*

Good road to Dewas, thence to Indore fairly good.

Total ...175 Miles.

Note.—Motorists are recommended to rail between Indore and Bombay.

Map 7



Scale 24 Miles to 1 inch.

20 15 10 5 0 20 40 Miles

Map 8.

Indore to Dhulia—161 Miles.

Indore to Mhow ... ... 12 *Miles.*

Heavy traffic on this has made the surface lumpy.

Mhow to Khal Ghat ... ... 39 *Miles.*

After a clear run of 15 miles, careful driving becomes necessary as the road down the Ghats is narrow and winding. The descent into the Nerbudda is also steep. Enquiries should be made about the two temporary bridges over this river.

Khal Ghat to Tapti River ... ... 80 *Miles.*

As far as Sendwa the road is very bad. Thence to the river it is good.

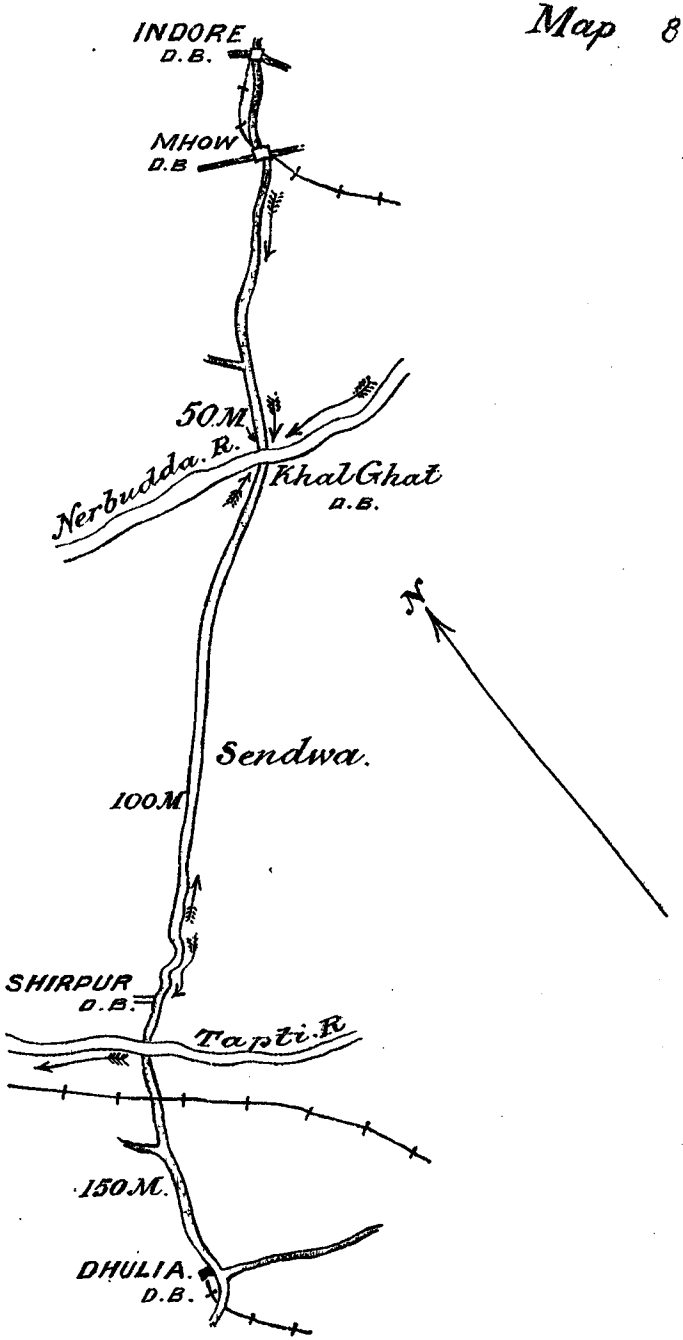
Tapti River to Dhulia ... ... 30 *Miles.*

Good level road. The river has to be crossed on boats, there being no bridge.

Total ... 161 Miles.

Note.—Motorists are recommended to go by rail between Indore and Bombay.

Map 8



Scale 24 Miles to 1 inch.

20 15 10 5 0 20 40 Miles

MAP 9.

Dhulia to Kalyan—183 Miles.

Dhulia to Malligaum ... ... 34 *Miles.*

A stiff uphill climb for the first mile or two, then good going.

Malligaum to Nasik ... ... 66 *Miles.*

About 20 miles from Malligaum the road zig-zags down the Ghats.

Nasik to Igatpuri ... ... 26 *Miles.*

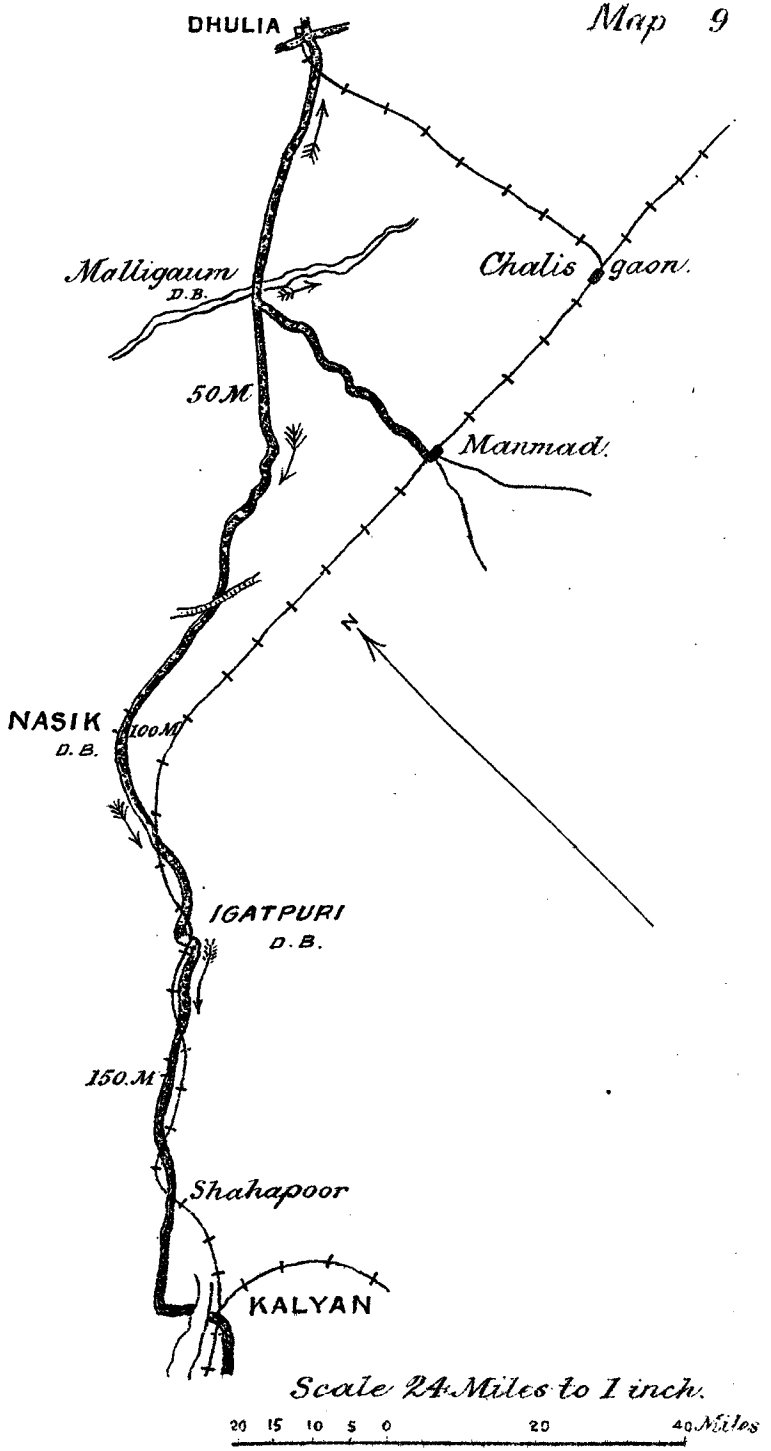
A good run down hill on a very fair road.

Igatpuri to Kalyan ... ... 57 *Miles.*

Very bad road. Numerous Irish bridges. A broad stretch of water has to be crossed just before reaching Kalyan. Arrangements must be made for boats.

Total ... 183 Miles.

NOTE.—This road is not recommended to Motorists.


DHULIA
Map 9
Malligaum
D.B.
Chalis gaon.
50M
Manmad.
N
NASIK
100M
D.B.
IGATPURI
D.B.
150.M
Shahapoor
KALYAN
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 Miles

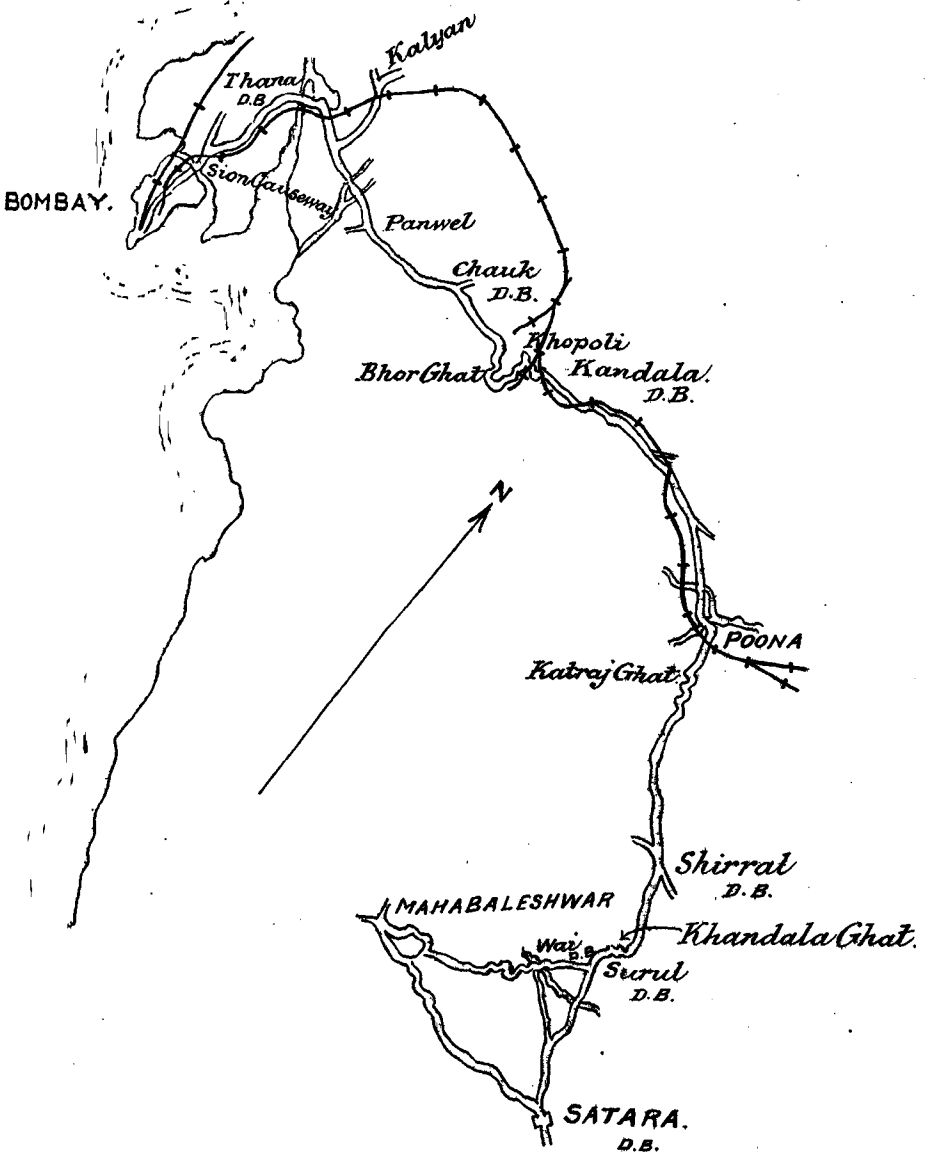
MAP 10.

Bombay to Satara—183 Miles.

Between Bombay and Panwel careful driving is, in several places, necessary, especially after leaving Thana. From Panwel to Poona the road is, for the most part, very good. Over the Bhor Ghat between Khopoli and Khandala the road is winding, and in places narrow. Soon after leaving Poona the Katraj Ghat is crossed by a good but winding road, and then there is a clear run until the Khandala Ghat is reached and careful driving will be necessary as far as Surul. From Surul to Satara the road is practically level and the "going" good.

BOMBAY TO SATARA.

Map 10

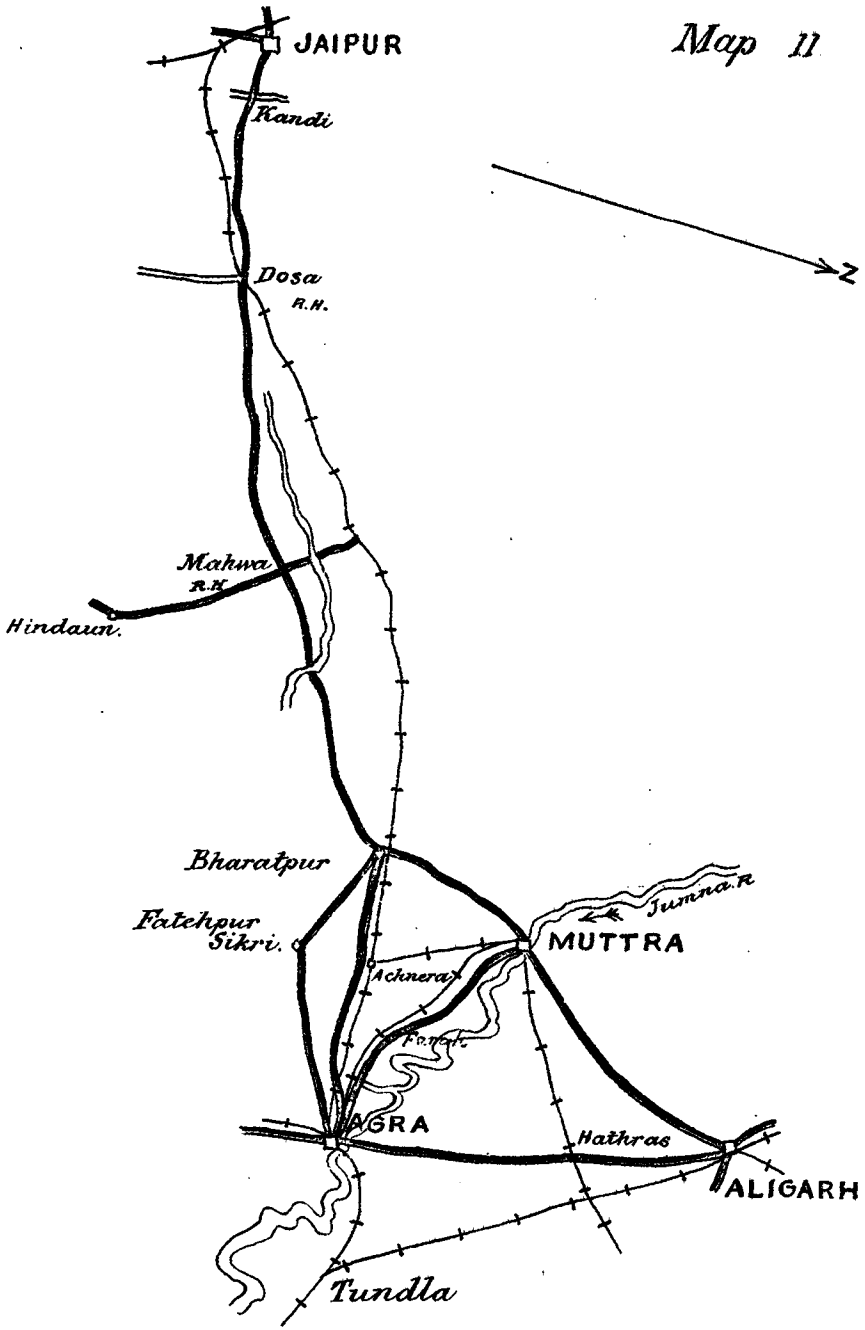


Scale 24 Miles to 1 inch

Map 11.

Jaipur to Agra—145 Miles.

Good metalled road throughout. The approach to Jaipur from Agra requires careful driving. In the rains some of the unbridged streams would become impassable, at other seasons they present no difficulty. There are hotels at Jaipur and Agra. And petrol is procurable at the latter place from the Agents of the Bombay Motor Car Company at Rs. 16-8-0 per 8-gall. drum.


Map II
JAIPUR
Kandi
Dosa
R.H.
Mahwa
R.H.
Hindaun.
Bharatpur
Fatehpur
Sikri.
Jumna R.
MUTTRA
Achnera
AGRA
Hathras
ALIGARH
Tundla
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 Miles.

MAP 12.

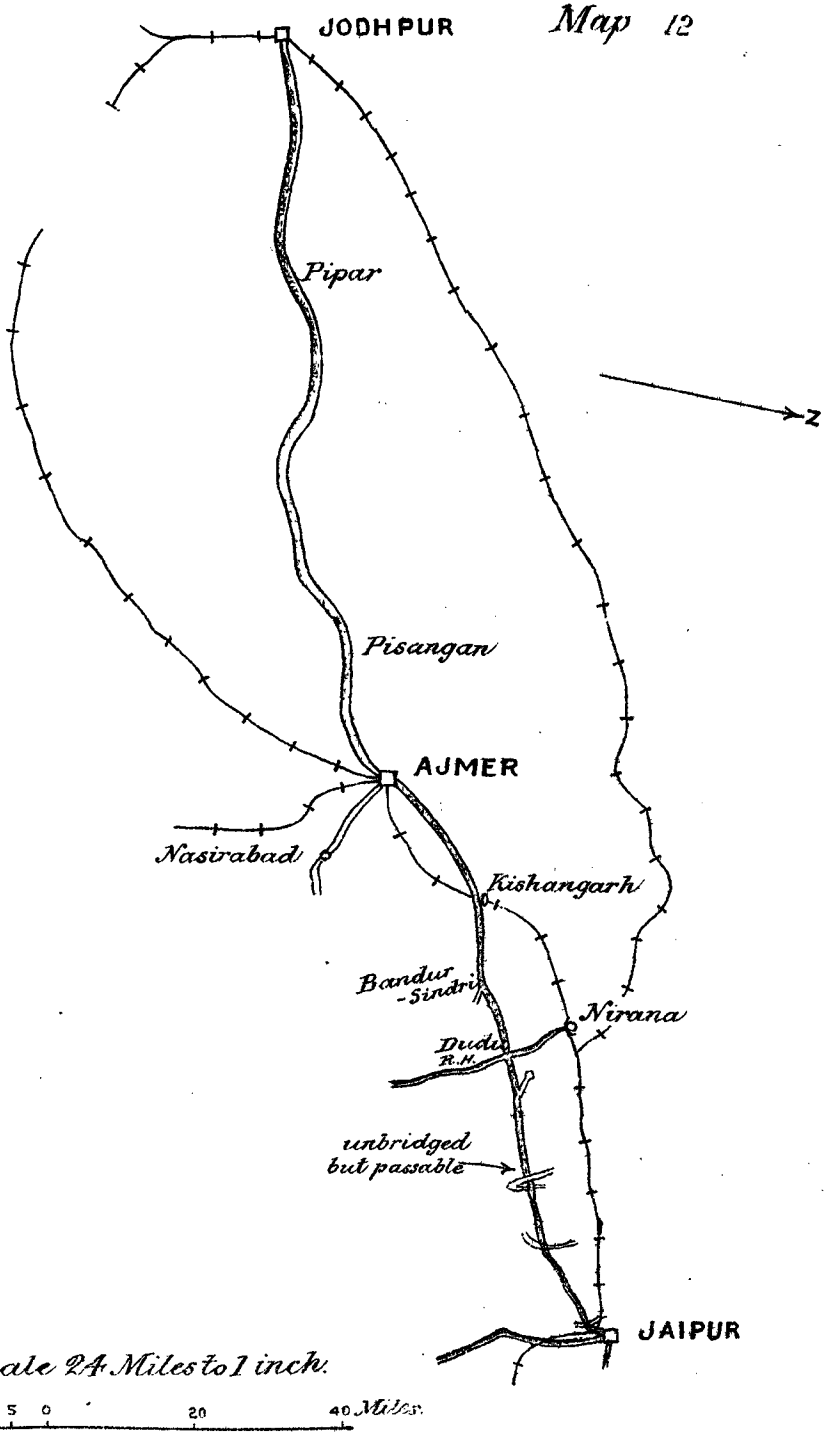
Jaipur to Jodhpur.

Jaipur to Ajmer ... ... 83 *Miles.*

The road is metalled and in good order, but in the rains some of the streams are impassable. There are no long or steep gradients. There are two hotels in Jaipur, a rest house at Dudu, half way between Jaipur and Ajmer, and an hotel and dâk bungalow at the latter place.

Ajmer to Jodhpur ... ... *about* 105 *Miles.*

This road is in a very bad state and is not fit for motoring. Petrol is at present unobtainable at any of the abovenamed places.


JODHPUR
Map 12
Pipar
Z
Pisangan
AJMER
Nasirabad
Kishangarh
Bandur
Sindri
Nirana
Dudu
R.H.
unbridged
but passable
JAIPUR
Scale 24 Miles to 1 inch.
15 10 5 0 20 40 Miles.

Bangalore to Madras—221 Miles.

I am indebted to Mr. G. V. Scovell (Bikashipur Estate near Bangalore) for a description of this road.

This gentleman has an extensive motoring acquaintance with the principal roads of Southern India.

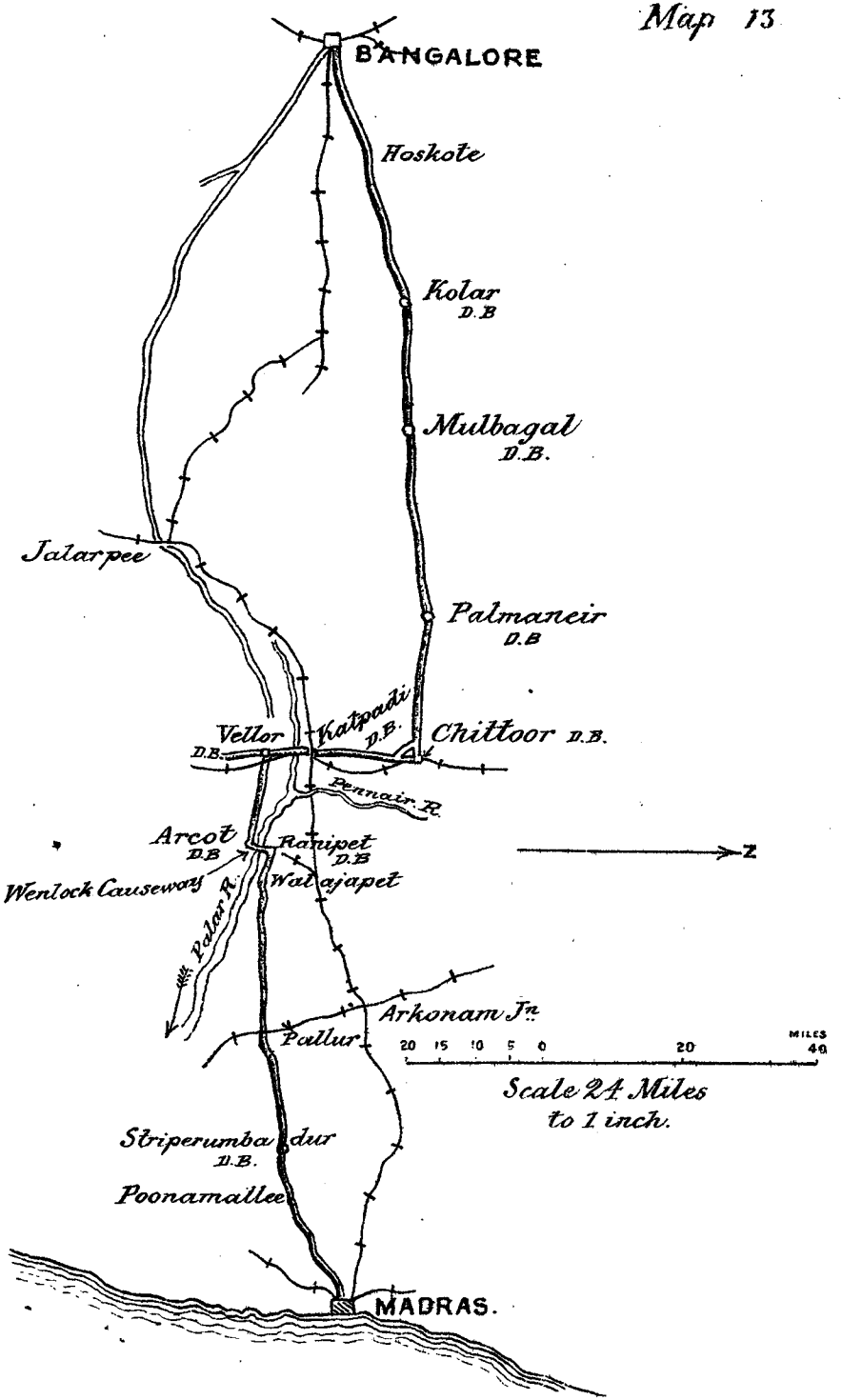
Bangalore to Katpadi ... ...130 *Miles.*

The first few miles are bad, but improves, and from Hoskote (15 miles) to Kolar, the road is splendid. At Mulbagal, 20 miles from Kolar, there is a good traveller's bungalow. Mulbagal to Palmaneir is a run of 27 miles, the road surface good, except for a few Irish bridges, with several easy down gradients. On leaving Palmaneir the descent of the ghauts begins. The gradient is not steep, about 1 in 15, and there are no sharp turns, still careful driving is necessary as there are occasional cross drains. The fall between Palmaneir and Chittoor is about 1,200 ft. Chittoor can be avoided by turning off the main road, 2 miles short of Chittoor, at a place called Graemespet. From this point to Katpadi the road is good, but there are innumerable Irish bridges which should be crossed at a very low speed. There is an excellent refreshment room at Katpadi railway station.

Katpadi to Madras ... . 91 *Miles.*

The Palar river is spanned by a long narrow bridge. Just before entering Yellore the Madras road turns to the left to Arcot. This part of the journey is a network of roads and most confusing. The river is crossed at Wenlock causeway. The causeway itself is narrow, but lighted at night, and the approaches easy. On arriving at Ranipet a sharp turn to the right down a side street leads to the trunk road. From Walajapet to within a few miles of Madras the road is good and easily followed, cattle and carts presenting the only obstacles to fast driving.

Map 13


BANGALORE
Hoskote
Kolar
D.B
Mulbagal
D.B.
Jalarpee
Palmaneir
D.B
Vellor
D.B.
Katpadi
D.B.
Chittoor D.B.
Pennair R.
Arcot
D.B
Ranipet
D.B
Wenlock Causeway
Walajapet
Palar R.
Arkonam Jn
Pallur
20 15 10 5 0 20
MILES
40
Scale 24 Miles
to 1 inch.
Striperumba dur
D.B.
Poonamallee
MADRAS.

MAP 14.

Gwalior to Saugor—183 Miles.

Gwalior to Jhansi ... ... 58 *Miles.*

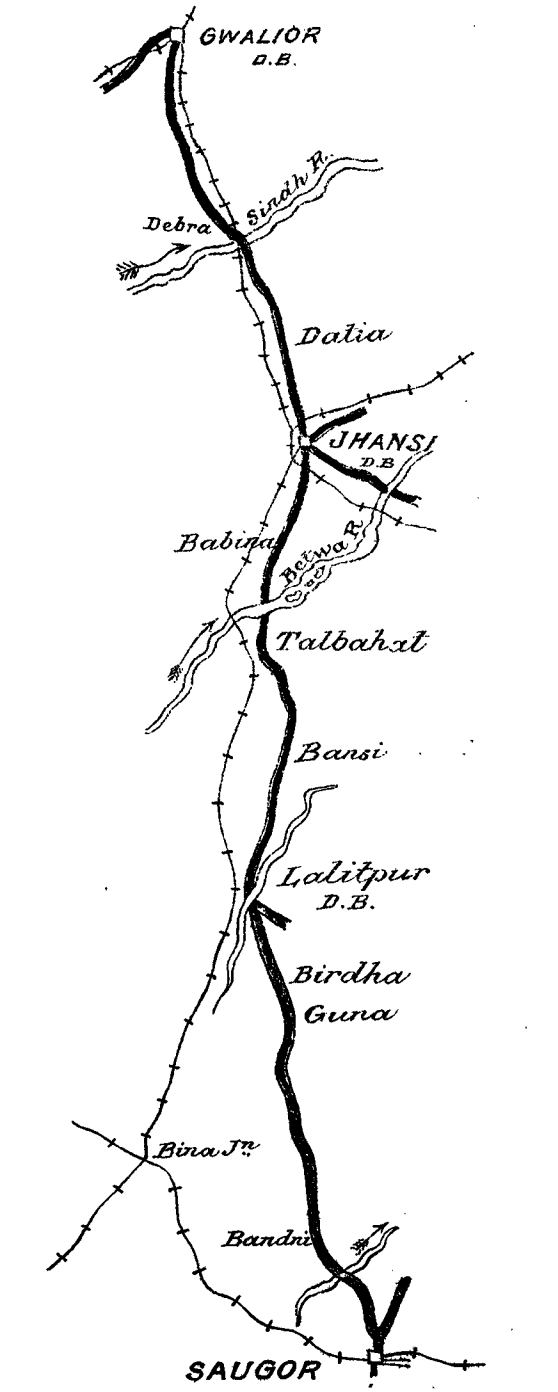
The road is, generally speaking, very good, the only serious obstacle being the Sindh river. This is crossed by a temporary bridge in the dry season, and by boat ferry in the rains.

Jhansi to Lalitpur ... ... 60 *Miles.*

Road very good, but careful driving is necessary as there are several sharp bends at villages. There are also several unprotected causeways. The Betwa river can be crossed in the dry season by a paved causeway, but in the rains it would form a serious obstacle to a car. There is also a broken bridge at Talbahat which is being repaired (November 1905). There are inspection bungalows at Babina, Talbahat, Bansi, &c.

Lalitpur to Saugor ... ... 65 *Miles.*

Very good road. Guna stands on a hill, but the gradient ascending and descending is easy.


GWALIOR
D.B.
Sindh R.
Debra
Datia
JHANSI
D.B.
Babina
Betwa R.
Talbahat
Bansi
Lalitpur
D.B.
Birdha
Guna
Bina Jn.
Bandri
SAUGOR
N
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 Miles.

MAP 15.

Katni Junction to Nagpur—205 Miles.

Katni to Jubbulpore ... ... 54 *Miles.*

Good metalled road.

Jubbulpore to Nagpur ... ...151 *Miles.*

Excellent road, bridged and metalled throughout.

Saugor to Nagpur.

Saugor to Nasingpur ... ... 68 *Miles.*

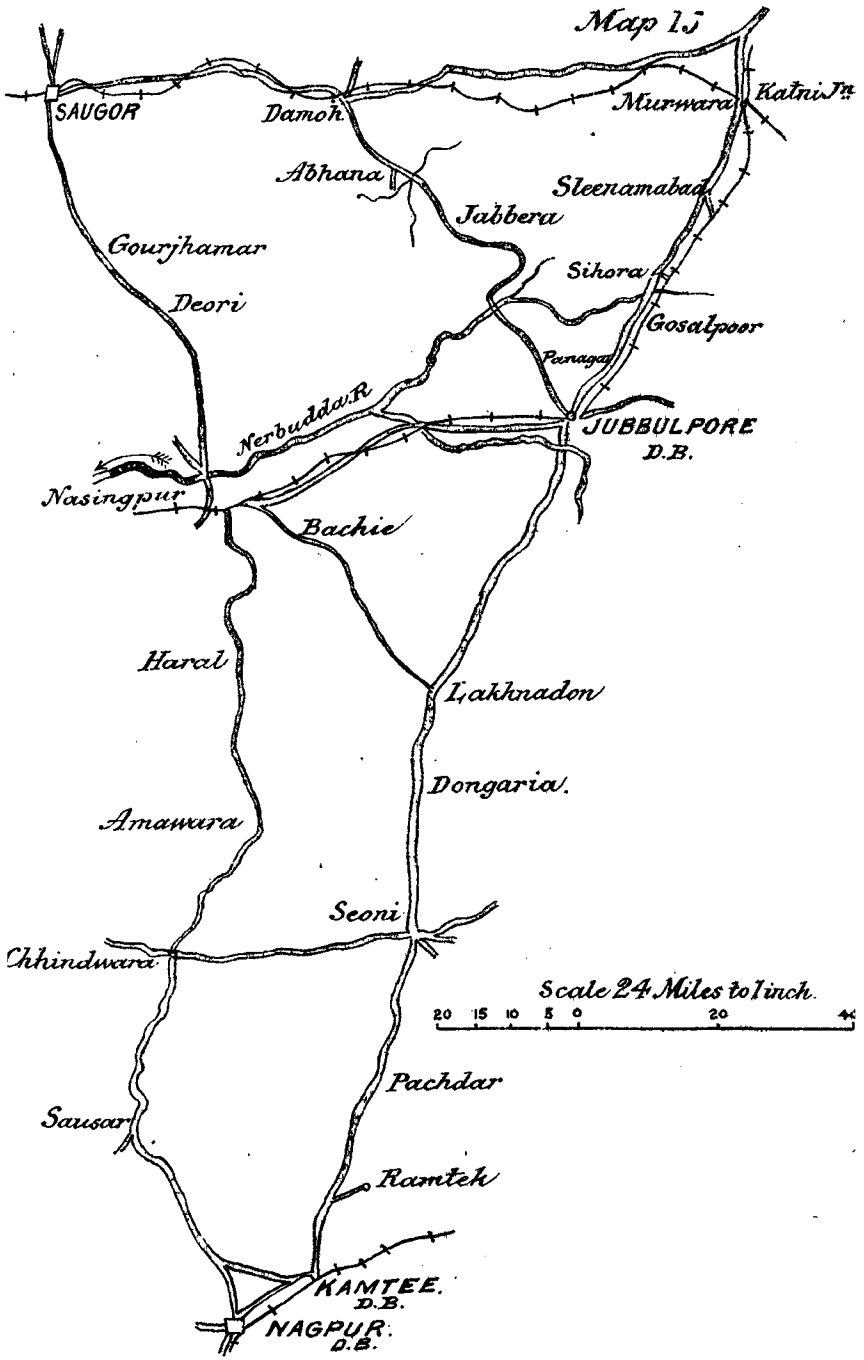
Fair metalled road, partially bridged.

Nasingpur to Chhindwara ... ... 70 *Miles.*

Hilly road, partially bridged and metalled.

Chhindwara to Nagpur ... ... 62 *Miles.*

Good metalled road, partially bridged.


Map 15
SAUGOR
Damoh
Murwara
Katni Jn.
Abhana
Sleenamabad
Jabbera
Gourjhamar
Deori
Sihora
Gosalpoor
Panagar
Nerbudda R.
JUBBULPORE
D.B.
Nasingpur
Bachie
Haral
Lakhnadon
Dongaria
Amawara
Seoni
Chhindwara
Scale 24 Miles to 1 inch.
20 15 10 5 0 20
Pachdar
Sausar
Ramtek
KAMTEE.
D.B.
NAGPUR.
D.B.

Map 16.

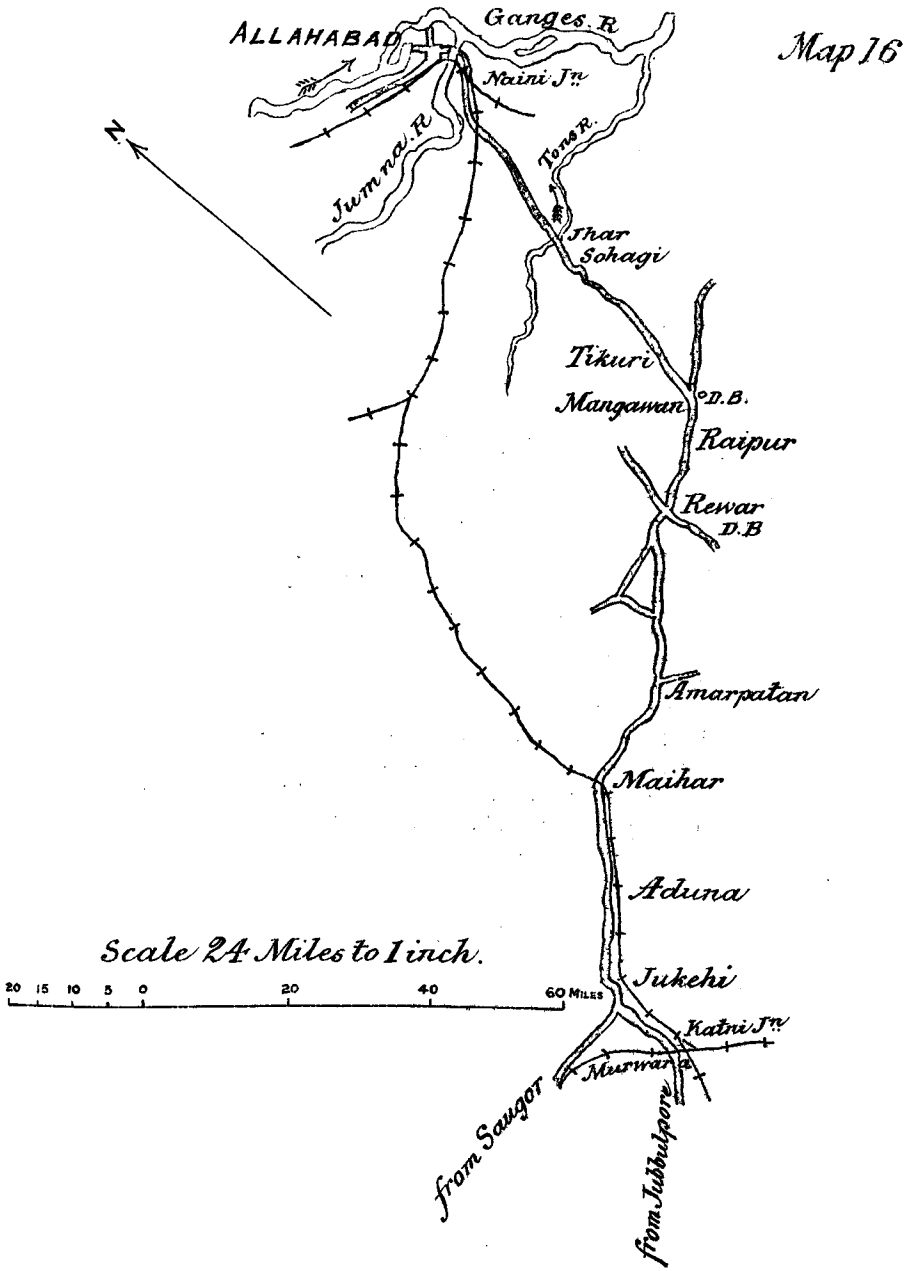
Allahabad to Katni Junction—165 Miles.

Allahabad to Mangawan ... ... 63 *Miles.*

Fair unmetalled road. The Tons River is crossed on boats, or on a small boat bridge during seven months in the year. Immediately south of Sohagi the road crosses a low range of hills, the northern slope being the steeper, but the gradient is nowhere more than 1 in 20.

Mangawan to Katni Junction ... ...102 *Miles.*

From Mangawan southwards the road is the Great Dakan Road. This is metalled throughout. There are a number of causeways, the approaches to which are easy. At Rewah, 18 miles from Mangawan, there is a dak bungalow. Except for the low hills above mentioned the road is practically flat.


Map 16
ALLAHABAD
Ganges R.
Naini Jn
Jumna R.
Tons R.
N
Thar
Sohagi
Tikuri
Mangawan
D.B.
Raipur
Rewar
D.B
Amarpatan
Maihar
Aduna
Jukehi
Katni Jn
Murwara
from Saugor
from Jubbulpore
Scale 24 Miles to 1 inch.
20 15 10 5 0 20 40 60 Miles

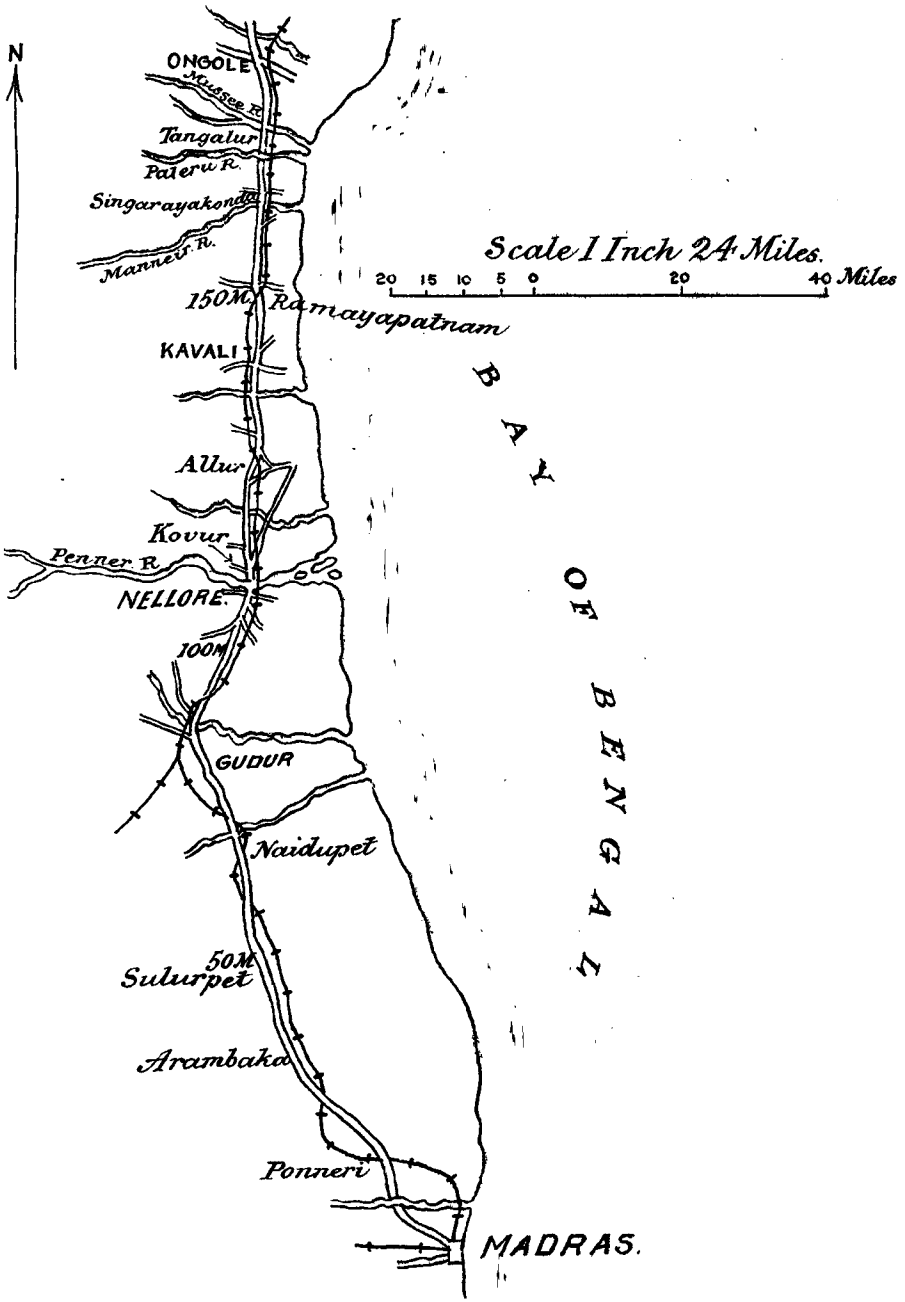
MAP 17.

Madras to Ongole—182 Miles.

The road from Madras to Ongole is level and for the most part good. Irish bridges are numerous, which necessitate careful driving at night. There are six unbridged rivers, *viz.*, between Madras and Ponneri, just north of Naidupet, the Penner, the Manneir, the Palera and the Mussee Rivers. These are impassable for a few days during the rains, when the railway (which, as will be seen, runs close to the road) must be made use of. There are dak bungalows at each of the towns whose names appear on the map, except at Ramayapatnam. Petrol is only obtainable in Madras, so it must either be sent by rail to stations on the line, or a large quantity must be carried on the car.

MADRAS TO ONGOLE

Map 17



Map 18.

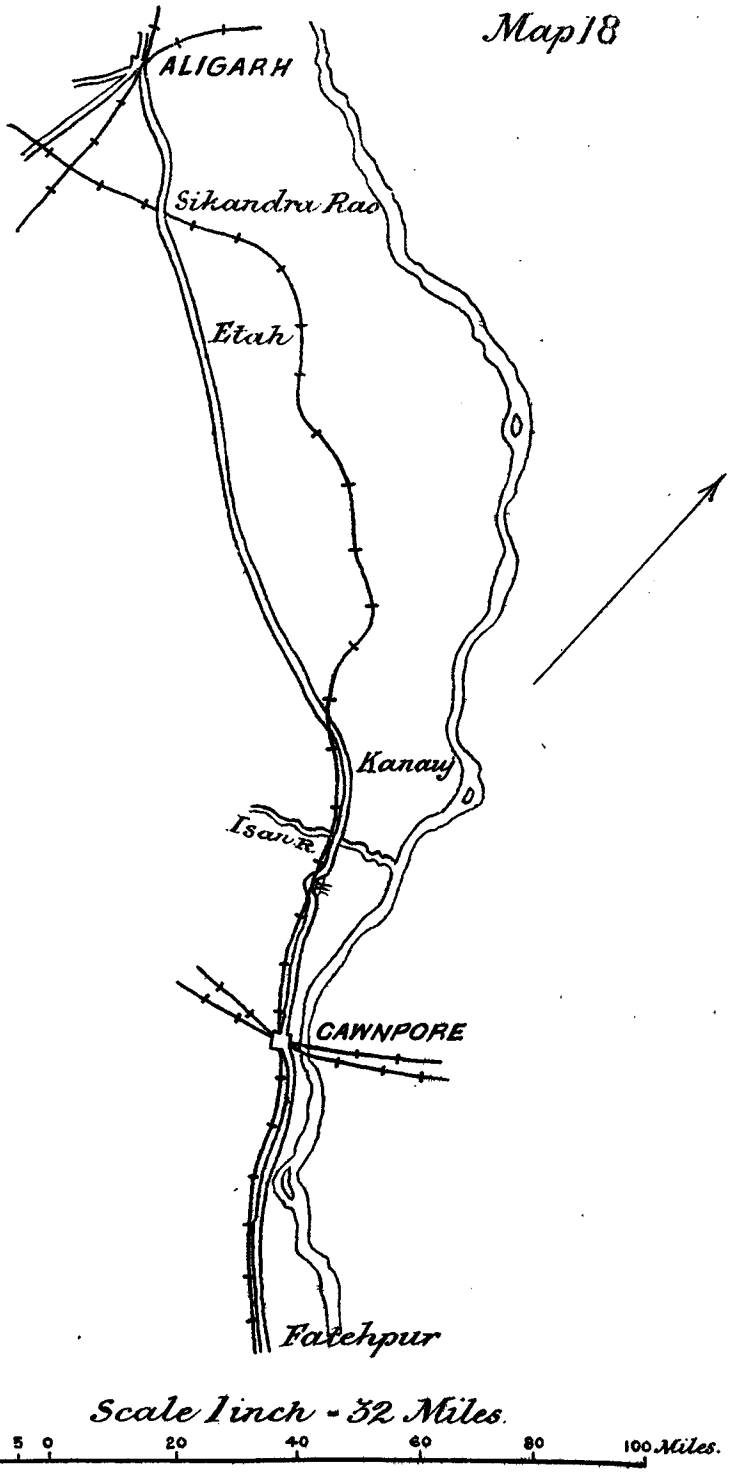
Fatehpur to Aligarh—225 Miles.

Fatehpur to Cawnpore ... ... 50 *Miles.*

Fatehpur is 77 miles from Allahabad. From Fatehpur to Cawnpore the road is level and from "fair" to "good." Petrol can be obtained at one of the Parsee shops near the Queen Victoria Statue.

Cawnpore to Aligarh ... ...175 *Miles.*

The road is for the most part level and good. Twenty-seven miles north of Cawnpore the road makes a sharp bend to the left and crosses the railway; three miles further on it bends suddenly to the right and re-crosses the railway. The Isan River is crossed on the railway bridge, there is no regular road track and care is necessary. Petrol is, I believe, obtainable in Aligarh from N. Shapoorjee, Merchant.

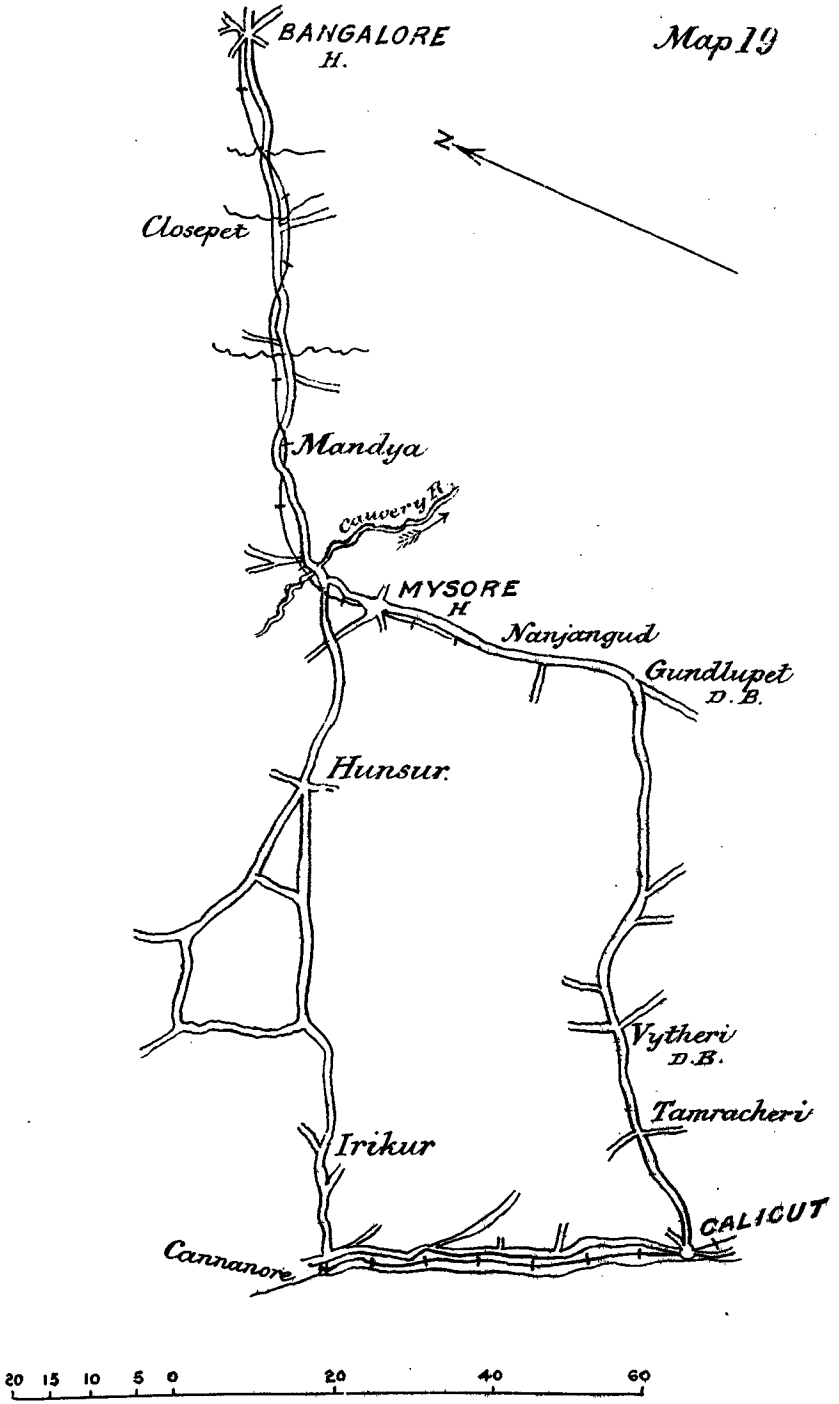

Map 18
ALIGARH
Sikandra Rao
Etah
Kanauj
Isan R.
CAWNPORE
Fatehpur
Scale 1 inch - 32 Miles.
20 15 10 5 0 20 40 60 80 100 Miles.

Map 19.

Bangalore to Calicut—215 Miles.

From Information supplied by Mr. G. V. Scovell.

Road between Bangalore and Mandya is fair, thence to Mysore it is excellent. The Gordon Hotel in Mysore can be recommended. Careful driving is necessary between Mysore and Gundlepet owing to the way in which the road is repaired. There is a very good traveller's bungalow at Gundlepet, also telegraph office. After leaving Gundlepet the road is narrow and bad for about twenty miles; it then becomes splendid for the rest of the way to Calicut. At Vytheri there is a good travellers' bungalow. A ghaut about 2,700 ft. has to be negociated between Vytheri and Tamracheri. The road surface is excellent and the gradient not steeper than 1 in 15, but there are three or four very sharp V shaped bends and the road is strewn with huge stones used by the cartmen to prevent their carts moving while the bullocks are resting. The Empress Hotel, Calicut, is good. The road from Mysore to Calicut *via* Hunsur and Cannanore is also a fair motoring road, between Cannanore and Calicut very good.


Map 19
BANGALORE
H.
N
Closepet
Mandya
Cauvery R.
MYSORE
H
Nanjangud
Gundlupet
D.B.
Hunsur
Vytheri
D.B.
Tamracheri
Irikur
CALICUT
Cannanore
20 15 10 5 0 20 40 60
Scale 1 Inch = 24 Miles.

Map 20.

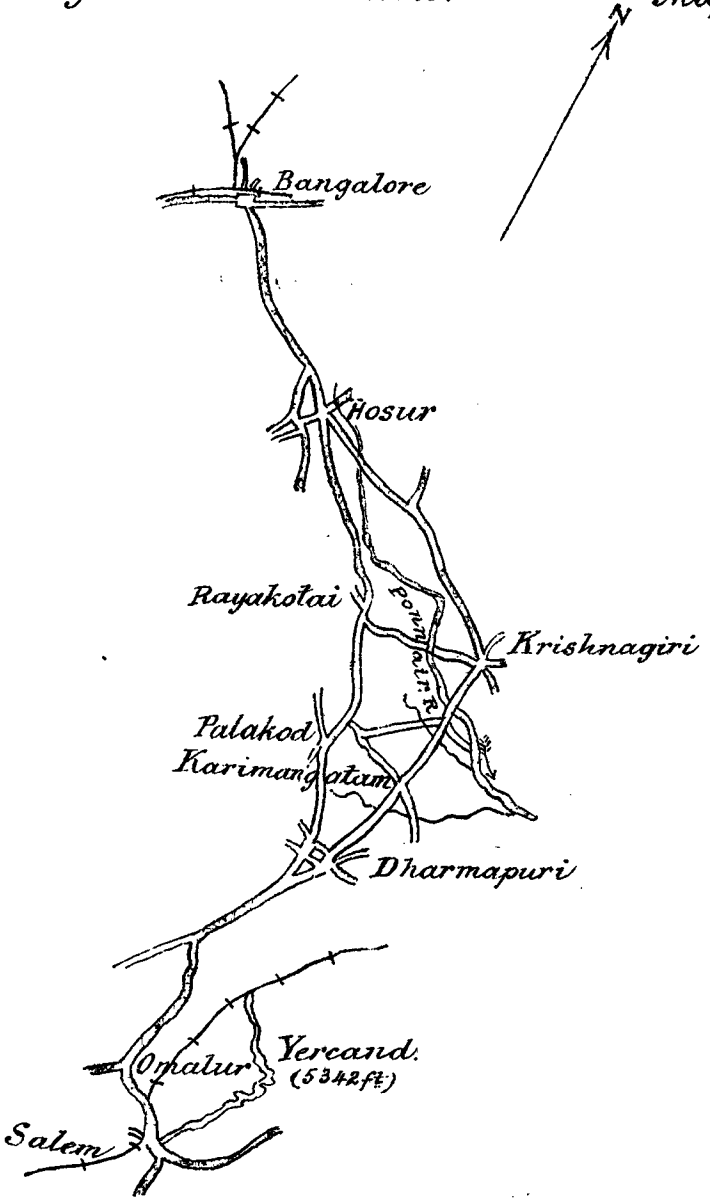
Bangalore to Yercaud—145 Miles.

From Information supplied by Mr. G. V. Scovell.

From Bangalore to Hosur the road is good. Mr. Scovell then took the road *via* Krishnagiri. Had he gone by Rayakotai he would not have had to cross the Ponnair River and might have found the road surface better. As it was, from Hosur to Krishnagiri he describes the road as the worst he has ever driven over. Between Krishnagiri and the Ponnair River the road was much better. The river presented a very serious obstacle, the bed being about ½ mile wide and consisting of soft sand. A large gang of villagers had to be requisitioned to haul the car across. A few miles further on a stream again necessitated the help of a number of cartmen, no village being within several miles. The road was bad until Omalur was reached, but between the last named place and Salem it was good. At Salem there is a dak bungalow, and at the railway station there is a good refreshment room and also sleeping accommodation. Seven miles from Salem the ascent of the ghaut begins. The gradient is about 1 in 15 to 1 in 18. The first half of the climb has one zig-zag, the second half sixteen. The zig-zags are exceedingly sharp and the road narrow. The Bellevue Hotel in Yercaud is clean and comfortable.

Bangalore to Yercand.

Map 20



20 16 10 5 0 20 40 Miles.

Scale 1 Inch = 20 Miles.

INDEX OF MAPS.

MAP 1—DELHI TO UMBALLA.

,, 2—UMBALLA TO LAHORE.

,, 3—LAHORE TO RAWALPINDI.

,, 4—RAWALPINDI TO PESHAWAR, ETC.

,, 5—DELHI TO AGRA AND DHOLPUR.

,, 6—DHOLPUR TO GOONA.

,, 7—GOONA TO INDORE.

,, 8—INDORE TO DHULIA.

,, 9—DHULIA TO KALYAN.

,, 10—BOMBAY TO SATARA.

,, 11—JAIPUR TO AGRA.

,, 12—JAIPUR TO JODHPUR.

,, 13—BANGALORE TO MADRAS.

,, 14—GWALIOR TO SAUGOR.

,, 15—NAGPUR TO SAUGOR AND KATNI JUNCTION.

,, 16—ALLAHABAD TO KATNI JUNCTION.

,, 17—MADRAS TO ONGOLE.

,, 18—FATEHPUR TO ALIGARH.

,, 19—BANGALORE TO CALICUT.

,, 20—BANGALORE TO YERCAUD.

APPENDICES.

APPENDIX I.

THE following are the concessions which can be obtained by purchasers of "The Motor Car in India" making use of accompanying form :—

Name of Car.	Firm offering the Concession.	Terms of the Concession.
ARGYLL ...	Argyll Motors, Ltd., Glasgow.	The Company will defray half the packing and shipping charges to Bombay. This offer to hold good for one year from date of publication of this volume.
DAIMLER ...	The Daimler Motor Car, Daimler Works, Coventry.	The car will be packed and put on boardship free of charge.
DARRACQ ...	Messrs. Hill, Sawyer & Co., Church Gate Street, Bombay.	A sum equivalent to half rail and shipping charges from England to Bombay will be deducted from the list price of the car. This offer to hold good for one year from date of publication of this volume.
DE DIETRICH..	Messrs. Jarrott & Letts, 45, Great Marlborough St., Regent St., London.	Half the packing charges, namely, £10, will be remitted.

Name of Car.	Firm offering the Concession.	Terms of the Concession.
DURYEA ...	The Duryea Coy., Widdrington Road, Coventry.	Car will be packed and put on boardship free of charge.
CROSSLEY ...	Messrs. Jarrott & Letts, 45, Great Marlborough St., Regent St., London.	Half the packing charges, namely, £10, will be remitted.
MARTINI ...	H. H. P. Deasy & Co., 54, Strand, London.	The Company will defray half the packing and shipping charges to Bombay.
NAPIER ...	Messrs. S. F. Edge & Co., 14, New Burlington St., Regent St., London.	The firm will pay the 5 per cent. duty charged on cars landing in India.
WHITE STEAM CAR.	White Steam Car Co., 35—37, King Street, Regent St., London W.	Car will be packed and put on boardship free of charge.
WINTON ...	The Winton Motor Carriage Co., 48, Holborn Viaduct, London.	The car will be packed and put on boardship free of charge.

The author would like it to be clearly understood that the above concessions were obtained entirely in the interests of his readers, and that he, personally, in no way benefits thereby; nor can he accept any further responsibility in connection with these concessions.

If on purchasing this volume the Concession Form is found to have been removed, please communicate the fact to the Publishers.

No. 73

"THE MOTOR CAR IN INDIA."

SPECIAL CONCESSION FORM.

To MESSRS. .....

.....

.....

DEAR SIRS,

Please allow me the special concession granted by you to users of this form.

Yours faithfully,

.....

.....

The Car ordered is .....

The terms of the concession are :—

.....

.....

.....

.....

.....

Note.—In order to prevent the unauthorized use of this form, it must be forwarded to Major D. Warren, c/o Manager, *Times of India*, Bombay, for counter-signature.

COUNTERFOIL No. 73

APPENDIX II.

LIST OF CARS ARRANGED ACCORDING TO PRICES.

SINGLE CYLINDER CARS.

H.P.	Make.	No. of Seats.	Bore and Stroke.	Drive.	Weight.	Wheel base.	Price.	Remarks.
			MM. MM.		Cwts.	Ft. Ins.	£	
6	Rover	2	95 × 110	Gear ...	6	6 0	105	With extra quality body, £120.
6	Wolseley	2	114 × 127	Chain ...	10½	5 6	175	
8	Mass	4	110 × 130	Gear ...	14	.....	185	
8½	Cadillac	2	127 × 127	Chain ...	10	6 2	189	With 4-seated body, £231.
6	Rover	2	114 × 130	Gear ...	9	6 6	200	,, 4 ,, ,, £225.
8	Siddeley	3	114 × 114	,, ...	11	6 0	200	
9	Darracq	4	112 × 130	,, ...	13	7 1	205	
8	Speedwell	4	110 × 120	,, ...	10½	6 6	245	
	De Dion	2	100 × 120	,, ...	...	6 2	245	

TWO CYLINDER CARS.

7	Star	2	90 × 115	Chain ...	10	7 0	175	
8	Stanley Steam Car	2	75 × 102	Gear ...	8½	6 6	180	
7	Swift	2	80 × 90	,, ...	...	6 6	200	
10	Allday	2	95 × 115	,, ...	11½	6 6	200	With 3-seated body, £220.
10	Minerva	4	90 × 115	Chain ...	13	6 0	210	,, 4 ,, ,, £246.
10	Stanley Steam Car	4	75 × 102	Gear ...	10	7 0	220	
10	Hallamshire	2	88 × 140	,, ...	13	6 3	250	
10	Clément	4	88 × 140	,, ...	15	7 3	255	
8	Wolseley		100 × 100	Chain ...	...	7 2	255	Chassis only.

10	Darracq	4	100 × 120	Gear ...	14	7	11	265		
8	Talbot	4	85 × 110	,, ...	11	6	6	275		
12	Belsize	2	100 × 110	,, ...	10	6	3	275		
10	Gladiator	4	90 × 140	,, ...	15	7	3	300		
12	Hallamshire ...	4	95 × 130	,, ...	14	7	8	300	With 8′ 6″ wheel base, £350.	
12	Darracq	4	110 × 120	,, ...	16	7	3	307	,, 8′ 8″ ,, ,,	£343.
10	Unic	4	100 × 105	,, ...	14½	6	6¾	315	,, 7′ 10″ ,, ,,	£350.
10	Beaufort	4	95 × 115	,, ...	14½	7	2	325		
12	Siddeley		115 × 115	Chain ...	13	9	6	325	Chassis only.	
12	Wolseley		115 × 127	,, ...	...	8	6	325	,, ,,	
12	M. M. C.	4	110 × 145	,, ...	17	7	0	335		
10	Talbot	4	100 × 120	Gear ..	14	9	1	340		
10	Argyll	4	95 × 140	,, ...	14½	6	3	350	With 7′ 9″ wheel base, £380.	
12	Gladiator	4	105 × 140	,, ...	16	8	3	355		
10	Peugeot	4	105 × 105	Chain ...	14½	7	6	395		
16	Albion	4	125 × 130	,, ...	21½	7	0	400		
14	Dennis	4	105 × 130	Worm ...	17	8	6	400		
20	Winton	4	133 × 153	Chain ..	18¾	7	10½	400		
12	DeDion	4	100 × 110	Gear ...	...	8	5½	410		
12	New Arrol-Johnston	4	108 × 165	Shaft ...	18	8	9	410		
10	White Steam	4	76 × 89 127 × 89	Live axle ...	15	6	8	420		
12	Beaufort	4	120 × 130	Chain ..	19	8	2	425		
12	Lanchester	4	133 × 150	Worm ...	20	8	0	500	With side entrance body, £525.	
15	White Steam	4	76 × 89 127 × 89	Live axle ...	18	7	9	550		
18	,, ,, ...	6	76 × 89 127 × 89	,, ,, ...	20	9	6	600		

H.P.	Make.	No. of Seats.	Bore and Stroke.	Drive.	Weight.	Wheel base.	Price.	Remarks.
	THREE CYLINDER CARS.							
			MM. MM.		Cwts.	Ft. Ins.	£	
9	Vauxhall	2	80 × 110	Chain ...	12	6 9	250	
9	Swift	3	80 × 90	Gear ...	...	6 8	275	
10	Horbeck Minor ...	4	80 × 90	,, ...	13½	6 6	300	
8	Panhard	...	80 × 120	Chain ...	17½	8 3	320	Chassis only.
12	Vauxhall	4	95 × 115	,, ...	15	7 2	375	
15	Duryea	2	115 × 115	,, ...	13½	6 6	395	
10	Turner Miesse Steam	4	50 × 80	,, ...	19	7 6	431	Paraffin fuel.
18	Star	4	130 × 130	,, ...	19	8 6	500	
18	Belsize	4	120 × 130	Gear ...	19	9 7	550	
16	Maudslay	4	115 × 100	Chain ...	17½	8 6	600	
16	Turner Miesse Steam	6	59 × 89	,, ...	24	7 6	416	Paraffin fuel.
15	Lea-Francis	4	100 × 150	,, ...	...	7 9	850	
	FOUR CYLINDER CARS.							
8	Leader	2	75 × 90	Gear ...	10	...	195	
10	,, ...	4	85 × 90	,, ...	12	...	225	
10	Star	4	75 × 100	Chain ...	14	7 6	260	
10	Humber (Coventry)	2	90 × 95	Gear ...	14½	7 1	280	4-seated side entrance body, £315.
12	Globe	4	80 × 90	,, ...	14	8 4	289	
10	Rover	4	75 × 100	,, ...	12	8 6	300	Fitted with Hitchon Gear.
10	Mass	4	80 × 100	,, ...	16	...	300	

12	Leader	...	4	95 × 125	,,	...	15	...		310	
14	Star ...	...	4	90 × 115	Chain	...	16	8	4	350	
12	Vulcan	...	4	80 × 110	Gear	...	15½	7	10	350	
16	Winton	...	4	90 × 127	,,	...	15¾	7	4	360	
18	Iden ...	...	4	97 × 120	,,	...	17	7	7½	370	
12	Hallamshire	...	4	84 × 110	,,	...	14	7	11	375	
16	Allday	...	4	95 × 120	,,	...	14	8	9	375	
18	Brown	...	4	100 × 110	,,	...	17	8	2	375	
16	Minerva	...	4	90 × 115	,,	...	17	8	10	395	
16	Rover	...	4	95 × 110	,,	...	...	9	0	400	
14	Mass	...	4	85 × 110	,,	...	17	...		400	
12	Swift ...	...	4	80 × 90	,,	...	...	8	3	400	
12	Clément	...	4	80 × 120	,,	...	17	8	4	400	
15	Royal Enfield	...	5	100 × 130	,,	...	24	10	0	420	
12	Simms Welbeck	...	4	82 × 90	,,	...	17	9	2	425	
14	Climax	...	4	80 × 90	,,	...	15	8	6	425	
14	Clément	...	4	85 × 120	,,	...	18	9	8	425	
20	Brown	...	4	110 × 120	,,	...	17⅓	8	6	425	
15	Siddeley	...	...	100 × 100	,,	...	...	9	6	425	Chassis only.
14	Gladiator	...	...	85 × 120	,,	...	18	9	7	425	,, ,,
15	Darracq	...	4	90 × 120	,,	...	18	7	11	447	With long chassis, £483.
14	Hallamshire	...	4	84 × 110	,,	...	16	8	5	450	
15	Leader	...	4	100 × 150	,,	...	18	...		450	
18	Star ...	...	4	100 × 130	Chain	...	19	8	6	450	
16	Unic ...	...	4	90 × 105	Gear	...	16	8	3	450	
12	Sunbeam	...	4	85 × 120	Chain	...	18½	7	10	452	
14	Argyll...	...	4	90 × 120	Gear	...	17	8	4	475	
18	Vauxhall	...	4	95 × 120	Chain	...	18	9	1	475	
16	Chenard-Walcher	...	4	85 × 130	Gear	...	19	8	4	485	
22	Minerva	...	4	100 × 115	,,	...	18	8	10	485	
16	Beeston Humber	...	4	95 × 125	,,	...	17	8	6	495	
24	Brown	...	4	115 × 130	,,	...	19	8	6	500	

FOUR CYLINDER CARS—*continued.*

H.P.	Make.	No. of Seats.	Bore and Stroke.	Drive.	Weight.	Wheel base.	Price.	Remarks.
			MM. MM.		Cwts.	Ft. Ins.	£	
20	Hallamshire	4	95 × 130	Gear ...	19½	9 6	500	
15	Horbeck	4	90 × 105	,, ...	18½	8 6	500	
18	Mass	4	100 × 130	Chain ...	19	...	500	
20	Simms-Welbeck ...	4	95 × 110	Gear ...	18½	9 2	500	
18	Gladiator	...	95 × 130	Chain ...	22	9 9	510	Chassis only.
18	Clément	4	95 × 130	Gear ...	22	9 10	525	
16	Swift	4	90 × 105	,, ...	...	8 9	525	
15	Orleans	4	90 × 110	,, ...	18	9 0	525	
16	Mascot	4	90 × 130	,, ...	17½	...	525	
18	Siddeley	...	117 × 100	Chain ..	...	9 6	525	Chassis only.
16	Sunbeam	4	95 × 120	,, ...	21	9 7	530	
15	De Dion	4	90 × 100	Gear ..	...	8 10	540	
20	Darracq...	4	110 × 120	,, ...	23	10 1	547	
16	Argyll	4	95 × 130	,, ...	18	9 0	550	
18	Regent	4	90 × 120	,, .	18	9 3	550	
12	Peugeot...	4	95 × 100	Chain ..	17½	9 3	550	
20	Standard	4	102 × 108	Gear ...	18½	9 0	550	
25	Winton	4	120 × 127	,, ...	19	8 9	550	
15	Dennis	4	95 × 120	Worm ...	17½	9 0	550	
30	Leader	4	114 × 153	Gear ...	22	...	550	
18	Beaufort	4	95 × 115	,, ...	22	8 9	560	
16	Fiat	...	110 × 125	Chain ..	...	9 5	560	Chassis only.
14	Thornycroft	4	95 × 95	Gear ...	18	9 4	565	
20	Mascot	4	95 × 130	,, ...	17½	...	575	

22	Orleans	4	100 × 120	,, ...	18½	9	6½	575	
12	De Dietrich	4	90 × 120	Chain ...	18	8	4	580	
20	Talbot	4	100 × 120	Gear ...	19	9	9	590	
20	Horbeck	4	108 × 114	,, ...	20	8	6	600	
18	Napier	...	90 × 100	Chain ...	14	8	7½	600	Chassis only.
16	Delaunay-Belleville ...	...	90 × 130	Gear ...	18	10	0	615	,, ,,
20	Pilain	...	114 × 150	,, ...	25	9	3½	620	Direct drive on all speeds.
25	Orleans	4	110 × 120	,, ...	19	9	0	625	
24	Gladiator	...	105 × 140	Chain ..	23	10	4	625	Chassis only.
24	Clèment	4	105 × 140	,, ...	23	10	5	625	
25	Siddeley	...	114 × 127	,, ...	...	10	0	625	Chassis only.
18	Benz	...	94 × 114	,, ...	20	9	7	635	,, ,,
20	C. G. V.	...	110 × 130	,, ...	24	12	6	640	,, ,,
20	Lanchester	4	100 × 75	Worm ...	19½	9	3	650	
20	Dennis	4	100 × 130	,, ...	19½	9	0	650	
30	Star	4	100 × 130	Chain ...	20	9	6	650	
20	Brotherhood	...	100 × 125	,, ...	16½	8	3	675	
24	Talbot	...	100 × 140	,, ...	20	9	10	680	
20	Crossley	4	110 × 130	Gear ...	18	9	4½	700	
28	Daimler	4	110 × 150	Chain ...	21½	8	8	700	
24	New Arrol-Johnston ...	4	108 × 127	Gear ...	24	9	6	700	
20	Maudslay	4	115 × 100	Chain ...	20	10	1½	715	
24	Fiat	4	125 × 150	,, ...	22	9	8	720	
24	Thornycroft	4	110 × 130	Gear ...	22	...		725	
25	Iris	4	108 × 133	,, ...	21	10	0	725	
20	Rolls-Royce	4	100 × 130	,, ...	17½	8	10	735	
28	Beaufort	4	120 × 130	Chain ...	24	9	6	735	
20	Turner-Miesse (Steam)	4	101 × 76	Gear ...	24	8	0	750	Paraffin fuel.
26	Argyll	4	105 × 140	,, ..	21	9	3	750	
16	De Dietrich	4	105 × 120	Chain ..	20	9	10½	750	
18	Peugeot	4	106 × 105	,, ..	19¾	...		750	
32	Siddeley	...	134 × 127	,, ...	...	10	2	750	Chassis only.

FOUR CYLINDER CARS—*continued.*

H.P.	Make.	No. of Seats.	Bore and Stroke.	Drive.	Weight.	Wheel base.	Price.	REMARKS.
			MM. MM.		Cwts.	Ft. Ins.	£	
24	Martini	4	100 × 130	Chain ...	21	9 2½	775	
24	Panhard	...	110 × 140	,, ...	23	9 6	800	Chassis only.
24	Leon Bollée	...	105 × 130	,, ...	23	9 8	800	,, ,,
24	Dennis	6	105 × 135	Worm ...	25	10 0	800	
30	Daimler...	4	125 × 150	Chain ..	22	8 8	800	Longer chassis at extra cost.
35	Talbot	...	120 × 140	,,	22	10 4	820	Chassis only.
28	Benz	...	105 × 130	Gear ...	22	10 4	835	,, ,,
30	C. G. V.	...	115 × 150	Chain ...	...	12 6	840	,, ,,
22	Crossley	4	110 × 130	,, ..	22	10 0	850	
28	Delaunay-Belleville ...	...	115 × 130	,, ...	20	...	850	Chassis only.
24	Itala	...	130 × 140	Gear ...	...	...	850	,, ,,
20	Mercedes	...	100 × 130	Chain ...	19	10 4	850	,, ,,
35	Iris	4	127 × 133	Gear ...	22	10 0	875	
45	Beaufort	6	140 × 150	Chain ...	28	10 6	900	
24	De Dietrich	4	120 × 120	,, ...	22	10 3	930	
40	Martini	4	125 × 140	,, ...	26	9 8½	935	
40	Crossley	4	135 × 150	,, ...	23	10 0	950	
40	Daimler...	4	135 × 150	,, ...	23	8 8	1,000	
50	Talbot	...	140 × 150	,, ...	24	10 8	1,000	Chassis only
30	Peugeot...	4	130 × 120	,, ..	22½	10 0	1,000	
28	Mercedes	...	110 × 140	,, ...	20½	10 4	1,010	Chassis only
40	Delaunay-Belleville ..	...	130 × 140	,, ...	22	...	1,040	,, ,,
40	Benz	...	120 × 130	,, ...	25	10 6	1,060	,, ,,
40	De Dietrich	4	140 × 130	,, ...	23	10 6	1,150	

50	Fiat	4	145 × 165	,,	...	22	9	10	1,150		
50	C. G. V....	...	140 × 160	,,	...	...	12	6	1,160	Chassis only.	
40	Leon Bollée	...	130 × 150	,,	..	24	10	0	1,200	,,	,,
45	Mercedes	...	120 × 150	,,	...	21	10	4	1,200	,,	,,
45	Napier	...	120 × 120	Gear	...	22	9	1	1,200	,,	,,
50	Itala	...	135 × 145	,,	...	...		...	1,100	,,	,,
70	Peugeot...	4	150 × 138	Chain	...	23	12	0	1,450		
70	Mercedes	...	140 × 150	,,	...	24	11	1	1,800	Chassis only.	

SIX CYLINDER CARS.

30	Standard	4	102 × 108	Gear	...	20	10	0	725	
18	Wilson Pilcher ...	4	95 × 95	,,	...	23	9	3½	750	
35	Orleans...	4	110 × 120	,,	...	20	9	10	800	
30	Ariel	...	115 × 120	,,	...	26½	9	10	850	Chassis only.
24	Belsize	4	100 × 110	,,	...	21	10	3	850	
50	Standard	...	120 × 127	,,	...	21	11	0	850	Chassis only.
35	Thornycroft	4	110 × 130	,,	...	25	11	7	890	
30	Clément...	4	95 × 130	Chain	...	24	10	5	890	
20	Gladiator	...	95 × 130	,,	...	23		...	890	Chassis only.
30	Rolls Royce	4	100 × 130	Gear	...	21½	9	4	945	
40	Napier	...	100 × 100	Chain	...	20	9	8	1,050	Chassis only.
60	Napier	..	130 × 100	Gear	...	26	10	9	1,500	,, ,,

LIST OF MAKERS OR ENGLISH AGENTS OF FOREGOING CARS.

	Cars.	*Addresses.*
1	Albion.	—Albion Motor Car Co., Scotstoun, Glasgow.
2	Allday.	—Allday & Onions Pneumatic Engineering Co., Birmingham.
3	Argyll.	—Argyll Motors, Ltd., near Glasgow.
4	Ariel.	—Ariel Motor Co., 127, Long Acre, W.C.
5	Beaufort.	—Beaufort Motor Co., 14 Baker St., W.
6	Belsize.	—Belsize Co., Clayton, Manchester.
7	Benz.	—Du Cros Mercedès, Ld., 127, Long Acre.
8	Brotherhood.	—Brotherhood Croker Motors, 19, Hanover Sq., W.
9	Brown.	—Brown Bros., 22 to 30, Great Eastern St., E.C.
10	Cadillac.	—Anglo-American Motor Car Co., 19, Heddon St., W.
11	C. G. V.	—London Motor Garage Co., 33, Wardour St., W.
12	Chenard Walcher.	—Chenard Walcher Motors, Ld, 37, Long Acre, W.C.
13	Clément.	—The Clement Motor Co., 3, Leicester St., W.C.
14	Climax.	—Climax Motors, Ld., Coventry.
15	Crossley.	—Jarrott & Letts, 45, Great Marlborough St., Regent St.
16	Daimler.	—Daimler Motor Co., Daimler Works, Coventry.
17	Darracq.	—A. Darracq & Co., 483, Oxford St., London.
18	De Dietrich.	—Jarrott & Letts, Ld., 45 Great Marlborough St., Regent St.

Cars. *Addresses.*

19 De Dion.—De Dion Bouton, Ld., 10, Great Marlborough St., Regent St.

20 Delaunay Belleville.—Burlington Carriage Co., 315, Oxford St., W.

21 Dennis.—Dennis Bros., Guildford.

22 Duryea.—Duryea Motor Co., Widdrington Works, Coventry.

23 Fiat.—Fiat Motors, 37 and 38, Long Acre, W.C.

24 Gladiator.—Gladiator Co., 8 and 9, Long Acre, W.C.

25 Globe.—Hitchon Gear & Automobile Co., Moscow Works, Church, Lancashire.

26 Hallamshire.—Durham Churchill & Co., Hallamshire Works, Sheffield.

27 Horbeck.—Horsfall & Bickham, Pendleton, Manchester.

28 Humber.—Humber, Ld., Beeston, Nottingham and Coventry.

29 Iden.—Iden Motor Car Co., Parkside, Coventry.

30 Iris.—Legros & Knowles, Ld., Willesden Junc., N. W.

31 Itala.—Fabry Automobile Co., Ld., 71, New Cavendish St., W.

32 Lanchester.—Lanchester Motor Co., Sparbrook, Birmingham.

33 Leader.—New Leader Motors, Aspley Works, Nottingham.

34 Lea Francis.—Lea Francis Motor Syndicate, Lower Ford St, Coventry.

35 Léon Bollée.—Victoria Carriage Works, 121, Long Acre, W.C.

36 Martini.—H. Deasey & Co., 10, Brompton Rd., S.W.

37 Mascot.—Farman Automobile Co., 100 to 104, Long Acre, W.C.

38 Mass.—Lancaster Motor Garage, Lancaster Gate, W.

	Cars.	*Addresses.*
39	Maudslay.	—Maudslay Motor Co., Parkside, Coventry.
40	Mercedes.	—Du Cros Mercedes, Ld., 127, Long Acre, W.C.
41	Minerva.	—The Service Co., 292, High Holborn, London.
42	M. M. C.	—Motor Manufacturing Co., Parkside, Coventry.
43	Napier.	—S. F. Edge & Co., 14, New Burlington St., London.
44	New Arrol Johnston.	—New Arrol Johnston Co., Underwood, Paisley.
45	Orleans.	—Orleans Motor Co., Twickenham, Middlesex.
46	Panhard.	—Panhard & Levassor, 14, Regent St., W.
47	Peugeot.	—Friswell, Ld., 1 Albany St., London, N.W.
48	Pillain.	—W. Burgess, 40, Glasshouse St., Picadilly Circus, W.
49	Regent.	—S. F. Edge, Ld., 14, New Burlington St., London.
50	Rolls Royce.	—C. S. Rolls & Co., 14, Conduit St., London, W.
51	Rover.	—Rover Co., Ld., Coventry.
52	Royal Enfield.	—Enfield Autocar Co., Redditch.
53	Siddeley.	—Wolseley Tool & Motor Car Co., Birmingham.
54	Simms Welbeck.	—Simms Motor Manufacturing Co., Ld., Kilburn, N.W.
55	Speedwell.	—Speedwell Motor and Eng. Co., 151, Knightsbridge, S.W.
56	Standard.	—Standard Motor Co., Muchpark St., Coventry.
57	Stanley Steam Car.	— W. Galloway & Co., Gateshead.
58	Star.	—Star Engineering Co., Wolverhampton.
59	Sunbeam.	—Sunbeam Motor Car Co., Wolverhampton.

Cars. *Addresses.*

60 Swift.—Swift Motor Co., Coventry.

61 Talbot.—Clement Talbot, Ld., Ladbroke Grove, N. Kensington.

62 Thorneycroft.—John Thorneycroft & Co., Chiswick, W.

63 Turner-Miesse.—Turner Motor Manufacturing Co., Wolverhampton.

64 Unic.—Mann & Overtons, 7, Lower Belgrave St., S.W.

65 Vauxhall.—Vauxhall & West Hydraulic Eng. Co., Luton, Bedfordshire.

66 Vulcan.—Vulcan Motor Co., Southport, Lancashire.

67 White Steam.—White Steam Car Co., 35, King St., Regent St., W.

68 Wilson Pilcher—Armstrong, Whitworth & Co., 32, Great Peter St., Westminster.

69 Winton.—Winton Motor Carriage Co., 48, Holborn Viaduct, London.

70 Wolseley.—Wolseley Tool & Motor Car Co., Birmingham.

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